NOKIA

ACL2i Data Access Line Terminal

User Manual

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CE

The following products comply with the protection requirements of the European Union Council Directive 89/336/EEC relating to electromagnetic compatibility (EMC), provided that installed using EMC-compatible installation practices (installation in mechanical housings stated to be EMC-compatible and using cabling material [at least as well shielded] and practices as stated in relevant Nokia Networks user manuals):

Product code	Product name	Release
T65570.01	ACL2i Rack-mounted	
T65580.01	ACL2i Rack-mounted 110 V 90 mA (remote feed)	
T65590.01	ACL2i Rack-mounted (remote power)	

Contents

Summary of changes

Document	Date	Comment
DN02110174 Issue 1 en	18 Oct 2002	

1 About this manual

This user manual introduces the Nokia ACL2i data access line terminal and provides information needed for its installation and use.

The covered topics are:

- Introduction to ACL2i (Chapter 2)
- Applications (Chapter 3)
- Construction and interfaces (Chapter 4)
- Installation (Chapter 5)
- Commissioning (Chapter 6)
- Maintenance (Chapter 7)
- Using Q1 menus (Chapter 8)
- Technical specifications (Chapter 9).

Related documents

For more information about the DNT2Mi data network terminal, refer to the *DNT2Mi-sp/mp User Manual*.

2 Introduction

Nokia ACL2i is a data access line terminal intended for the central office. It provides a two-wire or four-wire SHDSL line interface (ITU-T G.991.2) and a symmetrical or coaxial 2M data interface (ITU-T G.703/G.704). In the Q1 menus, 2M data interface is referred to as a port interface.

The terminal is a plug-in unit, that can be used, for example, in the DYNANET 19” subrack or TM4 cartridges.

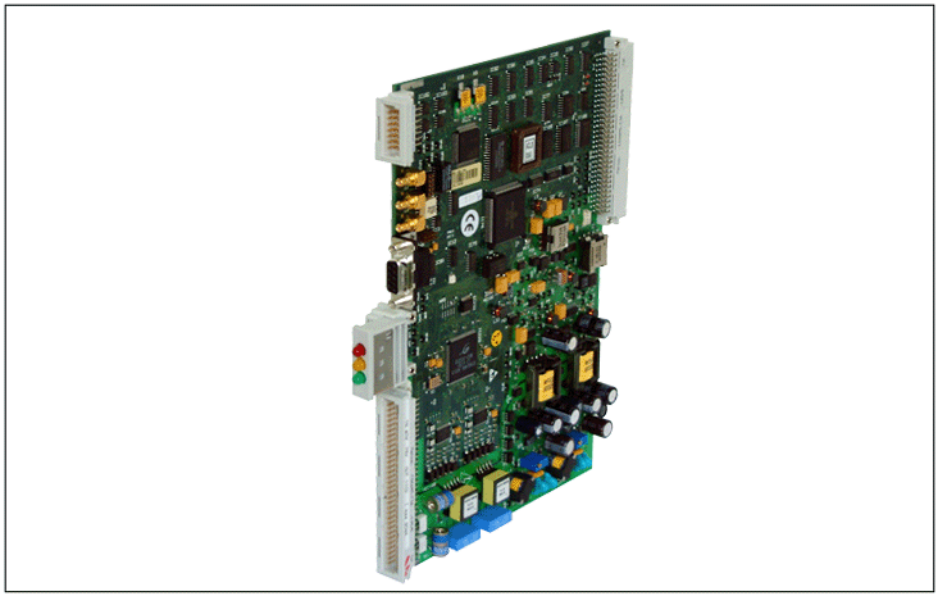


Figure 1. Example of ACL2i line terminal

2.1 Power supply

There are three different versions of ACL2i, differing in the mode of powering.

ACL2i

In the standard ACL2i, power is taken from the subrack in which the terminal is installed.

ACL2i-pf

In ACL2i-pf, power is taken from the subrack in which the terminal is installed. This line terminal can feed power to a repeater, DNT2Mi device, or ACL2i-rp terminal.

ACL2i-rp

ACL2i-rp is a remote-powered version receiving power via the SHDSL line.

2.2 Management

ACL2i is controlled through a software-based Q1 menu system, which is operated using the Nokia's hand-held Service Terminal, Microsoft Windows-based Macro Service Terminal Emulator (MSTE) program running on a PC, or Nokia's Network Management System (NMS).

The V.11/RS-485 Service/Data Interface on the front panel can be connected to a bus at the equipment site. All equipment connected to the bus can then be remotely controlled from one point using the Service Terminal, Macro STE, or Nokia NMS.

Local management

ACL2i can be managed locally with the Service Terminal or Macro STE. Local management can be utilised without removing the unit from the subrack.

The Service Terminal is connected to the Service Interface at the top of the unit's front panel and the Macro STE to the D-connector above the LED indicators (see Figure 5).

For more information about supported Windows operating systems, refer to the *Macro Service Terminal Emulator User's Manual*.

Remote management

ACL2i can also be managed remotely with Nokia's Network Management System (NMS). Nokia's NMS allows you to monitor faults and manage network elements (NEs). NMS has a graphical PC-based user interface.

For more information, refer to the documentation of Nokia's NMS products.

3 Applications

At the network site, the customer line is terminated by the ACL2i line terminal, which provides a 2048 kbit/s G.703/G.704 access to other equipment with a similar 2 Mbit/s interface (for example, Nokia ACM2, DM 2, DB 2, or DN 2).

At the customer end, the customer line can be terminated by an ACL2i or DNT2Mi terminal. DNT2Mi is a data network terminal which can be equipped with up to three interchangeable DTE interface units.

The basic applications of the ACL2i terminals are illustrated in Figure 2.

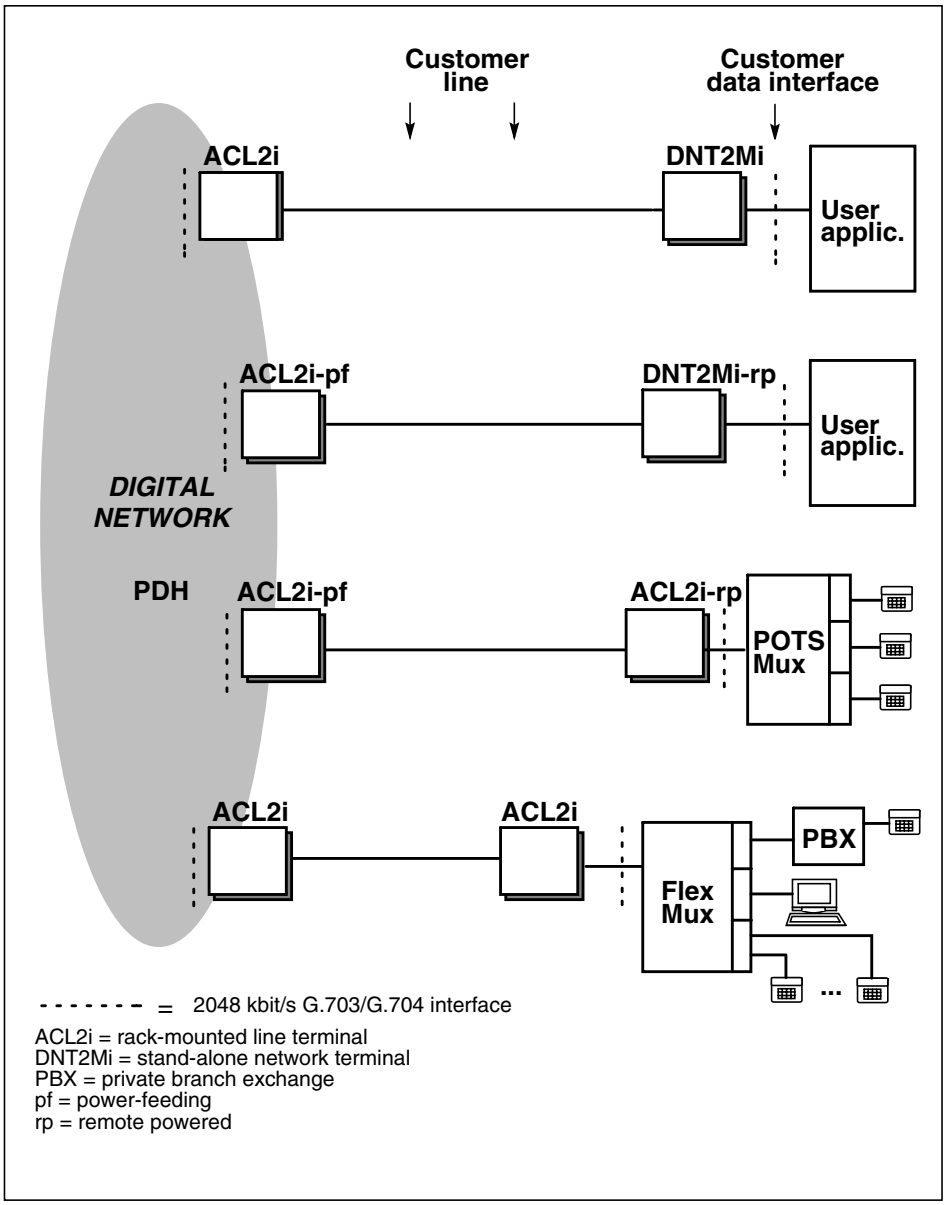


Figure 2. ACL2i network applications

4 Construction and interfaces

This chapter describes the mechanical construction, different interfaces, and power supply options of the ACL2i line terminal.

4.1 Mechanical construction

ACL2i is a plug-in unit used in the DYNANET mechanics family. It takes one plug-in unit space (5T) in a subrack or cartridge.

Figure 3 shows the mechanical construction of the ACL2i-pf unit.

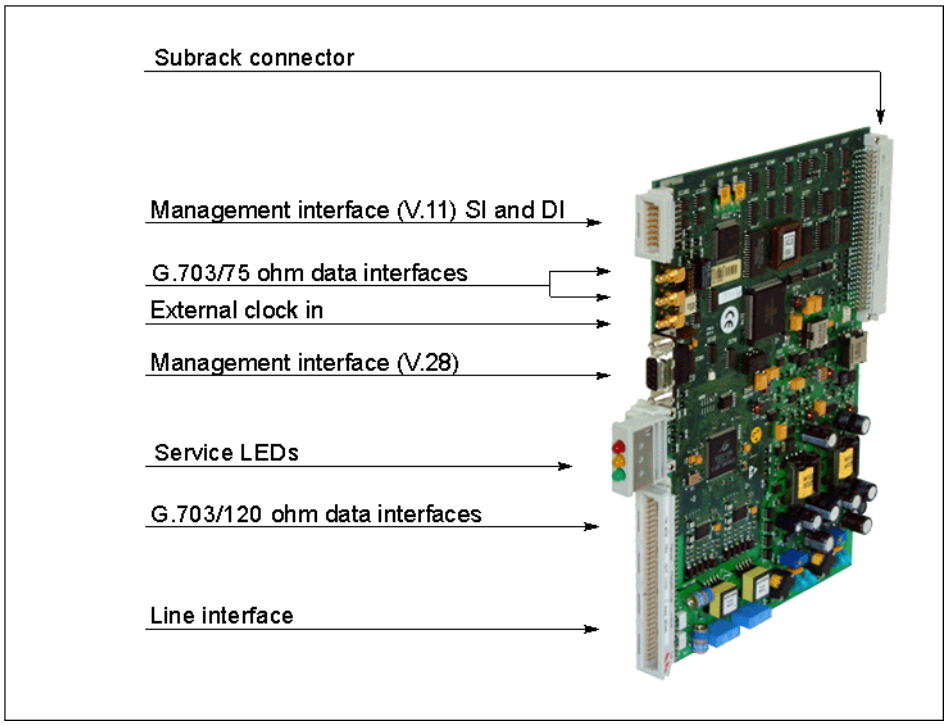


Figure 3. Mechanical construction of the ACL2i line terminal

4.2 Interfaces

This section describes the different interfaces located on the front panel of the ACL2i unit.

4.2.1 2M data interface

The physical layer of this interface complies with relevant ETSI and ITU-T Recommendations (for example G.703, G.823, and G.732). ACL2i has two 2M data interface alternatives located on the front panel: a 120-ohm symmetrical interface on the Euroconnector (see Figure 5) and a 75-ohm coaxial cable asymmetrical interface (SMB connectors marked as J1 and J2 in Figure 5).

For pin configuration of the 2M data interface, refer to Table 2.

The framing structure complies with the ITU-T Recommendation G.704 (2 Mbit/s interface) and the corresponding ETSI ONP standards: ETS 300 246, ETS 300 247, ETS 300 418, ETS 300 419.

4.2.2 Line interface

The line interface complies with the ITU-T Recommendation G.991.2.

The Q1 management channel is embedded in the frame structure of the SHDSL line. The Q1 management channel uses EOC bits of the SHDSL frame.

The line interface is located on the Euroconnector, see Figure 5. The pin configuration of the line interface is described in Table 2.

4.2.3 Alarm interface

On the ACL2i unit's front edge, there are two programmable alarm sources PA1 and PA2 located on the Management Interface connector P1 (see Section 9.4.3 and Figure 5). The pin configuration is described in Table 3.

On the unit's backplane, there are three open-collector alarms AA, AB, and AD located on the subrack connector P4 (see Section 9.4.3 and Figure 5). The pin configuration is illustrated in Table 1.

4.2.4 Management interface

The physical layer and the management protocol comply with Nokia's NMS management system.

ACL2i is a Q1-managed device, and it can be managed either locally or remotely. Local management is performed with a small, portable Service Terminal (V.11/RS-485 interface on connector P1) or with a Macro STE (V.28 interface on connector J4) running on a PC.

Network Management is executed using a Nokia NMS at the central management point.

4.2.5 External clock interface

The external 2M clock input is according to the ITU-T Recommendation G.703. The interface is on the SMB connector marked as J3 (see Figure 5).

4.3 Power supply

This section describes different power supply options for the ACL2i unit.

4.3.1 Battery voltage

The incoming battery voltage is fed through the EPSA 19” (Enhanced Power Supply Adapter) or the SPA (Subrack Power Adapter).

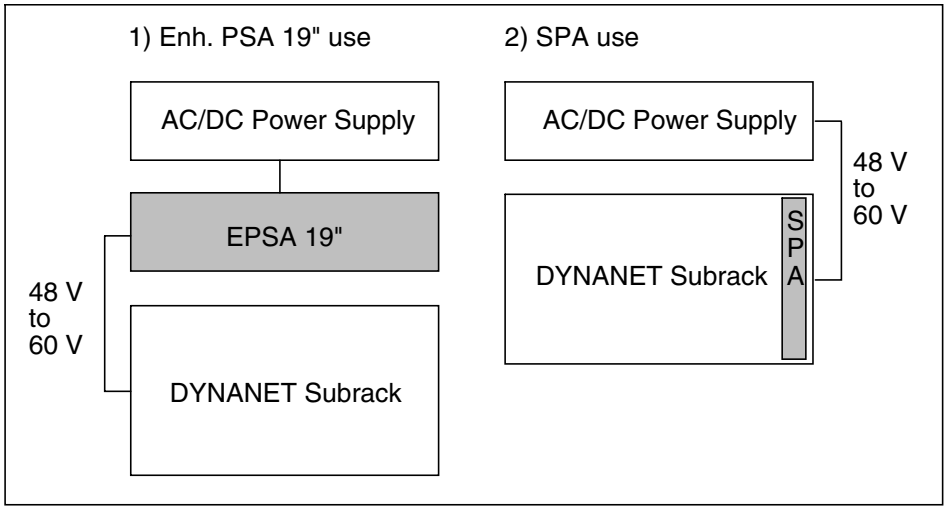


Figure 4. Power feed examples for ACL2i in a DYNANET subrack

In case of a power supply unit failure, an auxiliary +5 V voltage is applied to light up the red alarm LED and to drive external alarm outputs. This auxiliary voltage is fed from the SPA unit.

Refer to the documents of the subrack power adapters for detailed information on the operation of the power supplies.

4.3.2 ACL2i local power supply

- Powered from the battery voltage of the DYNANET subrack
- Operating range -39...-75 V.

4.3.3 ACL2i-pf remote power feed

- Powered from the battery voltage of the DYNANET subrack
- Operating range -39...-75 V
- Feeds power to a network terminal over SHDSL lines
- Can be set on and off through the network management
- Generates alarms in case of faults and failures.

4.3.4 ACL2i-rp remote-powered

- Power is taken from SHDSL lines
- Operating range 50...150 V
- Voltage fed over the line can be monitored through the network management.

5 Installation

This chapter gives instructions for installation of the ACL2i line terminal.

The covered topics are:

- General about installation (Section 5.1)
- Electromagnetic compatibility (Section 5.2)
- Connectors and pin numbering (Section 5.3)
- Strappings (Section 5.4)
- Connecting remote power lines (Section 5.5).

5.1 General

When installing the unit in a subrack or cartridge, make sure that you follow the appropriate cable and connector recommendations.

The line terminal is ready for operation after it has been installed in a subrack or cartridge and the cables have been connected.

Before the equipment is taken into use, the identifications and settings should be checked and, if required, the statistics and error counters reset.

Note!

The equipment is sensitive to static electricity. When handling the units and making hardware strappings, you should follow the general instructions concerning handling of ESD-sensitive equipment.

Wrist grounding or corresponding anti-static precautions should always be taken when handling a plug-in unit once it has been removed from its anti-static packaging.

Warning!

Do not touch the line or remote power circuits of the power feeding or remote powered ACL2i. Note also, that the plug-in units retain an electrical charge for a moment after they have been removed from the subrack.

A situation should be avoided in which the remote-powered ACL2i-rp is removed from the subrack with the line connection remaining operative.

5.2 Electromagnetic compatibility

Special EMC structures (for example DYNANET EMC subrack) must be used to meet the required electromagnetic compatibility (EMC). Shielded cables, required by these structures, must also be used.

For a specification of electromagnetic compatibility, see Section 9.7.2.

5.3 Connectors and pin numbering

This section describes ACL2i's connectors and pins in detail.

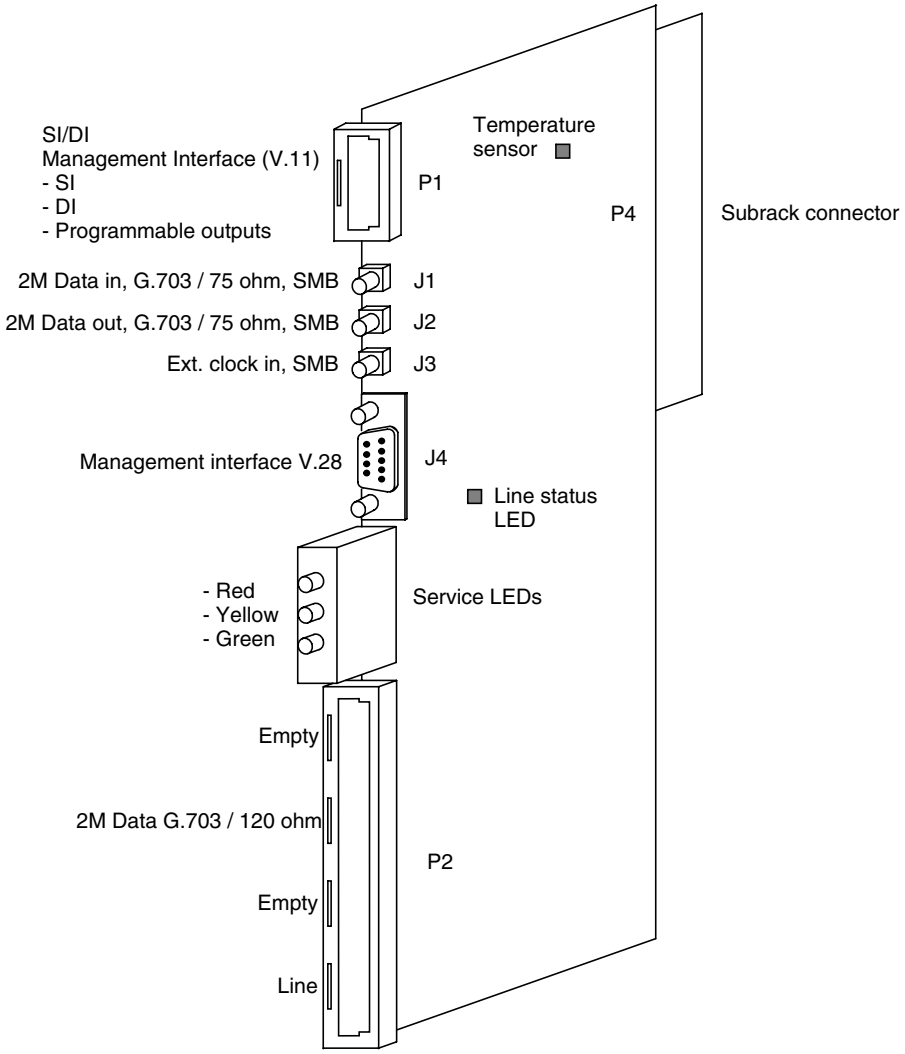
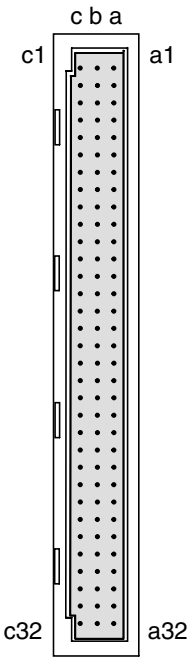


Figure 5. Connectors of the ACL2i terminal

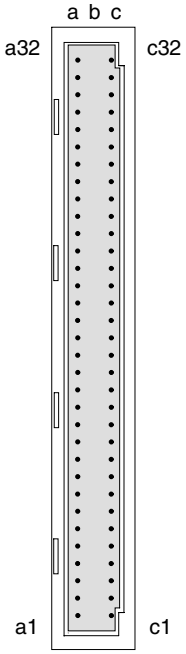
5.3.1 Subrack connector P4 (3 x 32; Euro; Male)

Table 1. Pins of subrack connector P4

Euroconnector	Pins of the subrack connector as seen from the back of the ACL2i unit				
	**Pin**	**c**	**b**	**a**	**Explanation**
	1				Not in use
	2	GND	GND	GND	Ground
	3-10				Not in use
	11	QBD (Q1)		QBU (Q1)	**Pin c:** Downstream Q1 bus (IN/OUT) **Pin a:** Upstream Q1 bus (IN/OUT)
	12		GND		Ground
	13-14				Not in use
	15			MPV5	Unit voltage (+5 V) (OUT)
	16				Not in use
	17	UA0			Unit address (IN, number of unit location in subrack)
	18	UA1			Unit address (IN, number of unit location in subrack)
	19	UA2		AA	**Pin c:** Unit address (IN, number of unit location in subrack) **Pin a:** Rack alarm A (OUT)
	20	UA3		AB	**Pin c:** Unit address (IN, number of unit location in subrack) **Pin a:** Rack alarm B (OUT)
	21	UA4		AD	**Pin c:** Unit address (IN, number of unit location in subrack) **Pin a:** Rack alarm D (OUT)
	22			VAP5	External auxiliary voltage +5 V (IN)
	23			GND	Ground
	24-29				Not in use
	30	VNB		VNB	Negative battery voltage (IN)
	31	VPB		VPB	Positive battery voltage (IN)
	32	OVG		OVG	Overvoltage ground

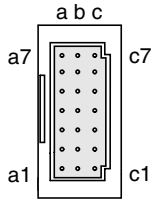
5.3.2 Signal connector P2 (2 x 32; Euro; Male)

Table 2. Pins of signal connector P2

Euroconnector	**Pins of the signal connector as seen from the front of the ACL2i unit**			
	**Pin**	**a**	**c**	**Explanation**
	32-24			Not in use
	23	RGND		G.703 pair cable ground
	22	R120		Input G.703 interface, 120 ohm (IN)
	21	RCOM		Input G.703 interface, 120 ohm (IN)
	20			Not in use
	19	TGND		G.703 pair cable ground
	18	T120		Output G.703 interface, 120 ohm (OUT)
	17	TCOM		Output G.703 interface, 120 ohm (OUT)
	16-15			Not in use
	14-12			**Pin a**: Reserved for testing purposes at the factory
	11-8			Not in use
	7	LINE_1A	OVG	SHDSL pair 1 Connection point of line cable ground
	6			Not in use
	5	LINE_1B		SHDSL pair 1
	4			Not in use
	3	LINE_2A		SHDSL pair 2, not in use in one pair connection
	2			Not in use
	1	LINE_2B		SHDSL pair 2, not in use in one pair connection

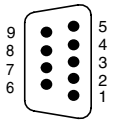
5.3.3 Service connector P1 (3 x 7; 1/4 Euro; Male)

Table 3. Pins of service connector P1

Euroconnector	**Pins of the service connector as seen from the front of the ACL2i unit**				
	**Pin**	**a**	**b**	**c**	**Explanation**
	7	ISA	IST	OSA	**Pin a:** Service interface, asynchronous, V.11/RS-485, Q1U (IN) **Pin b:** Termination of service interface **Pin c:** Service interface, asynchronous, V.11/RS-485, Q1U (OUT)
	6	ISB		OSB	**Pin a:** Service interface, asynchronous, V.11/RS-485, Q1U (IN) **Pin c:** Service interface, asynchronous, V.11/RS-485, Q1U (OUT)
	5	IDA	IDT	ODA	**Pin a:** Data interface, asynchronous, V.11/RS-485 (IN) **Pin b:** Termination of data interface **Pin c:** Data interface, asynchronous, V.11/RS-485 (OUT)
	4	IDB		ODB	**Pin a:** Data interface, asynchronous, V.11/RS-485 (IN) **Pin c:** Data interface, asynchronous, V.11/RS-485 (OUT)
	3				Not in use
	2	PA1		PA2	Two programmable alarm outputs (OUT), E/M level
	1		GND	PIN	**Pin b:** Ground **Pin c:** PIN signal

5.3.4 Local management connector J4 (9-pin D-connector; Female)

Table 4. Pins of local management connector J4

9-pole female D-connector	Pins of the local management connector as seen from the front of the ACL2i unit		
	**Pin**	**Signal**	**Explanation**
	1	DCD	109, constantly ON (OUT)
	2	RxD	104 (OUT)
	3	TxD	103 (IN)
	4	DTR	108 (IN)
	5	GND	Ground
	6	DSR	107, constantly ON (OUT)
	7	RTS	105, not in use (IN)
	8	RFS (CTS)	106 (OUT)
	9	RI	125, constantly OFF (OUT)

5.4 Strappings

The only hardware straps that can be set on the plug-in unit are the 2M data interfaces. The strappings and their location are shown in Figure 6.

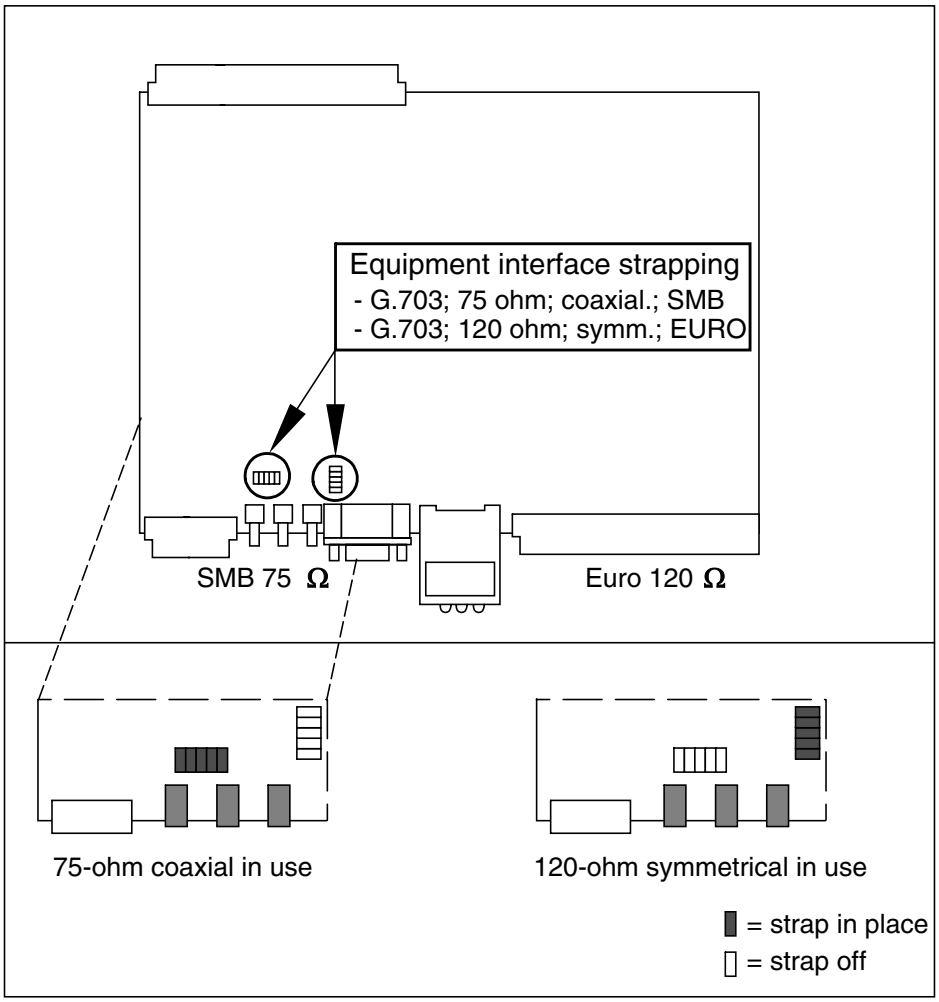


Figure 6. 2M data interface strappings

5.5 Connecting remote power lines

In the remote-powered ACL2i-rp, if the remote power feed is connected in a wrong way, that is, if the plus or minus wires between the pairs are cross-connected, the receiving remote unit still functions properly. However, in this situation data transfer is not possible (see Figure 7).

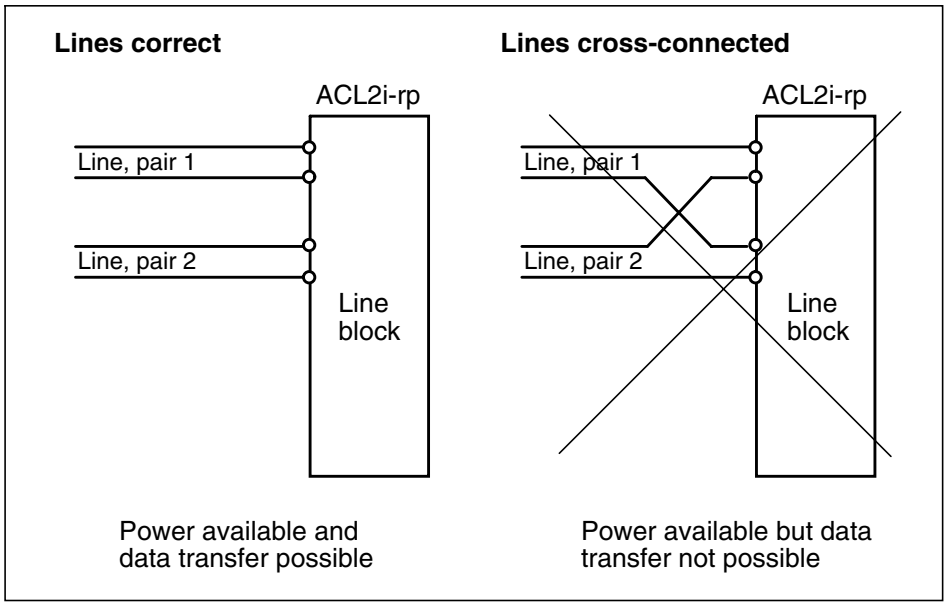


Figure 7. Remote power feed connection

6 Commissioning

This chapter describes the most common items that need to be checked before ACL2i is taken into use.

ACL2i is ready to operate after the power supply from the subrack (battery or remote power) and the 2M data interface and line cables are connected. However, the identifications and settings should be checked and, if required, the statistics and error counters reset.

ACL2i can be configured, tested, and controlled via:

- Service Terminal (using Q1)
- Macro Service Terminal Emulator running on a PC (using Q1).

Other Nokia management products, such as Nokia NMS, can be used for the same purpose.

Note

It can take up to 30 seconds to save the altered settings. If the power is switched off during this time, new settings will be lost. During the saving process, you can use the equipment normally.

6.1 Automatic power-up test

When the power is switched on, the unit performs an automatic self test, which is used to check the most vital operational functions of the equipment.

During the power-up test, the LEDs are lit in the following sequence:

- All the LEDs are lit for five seconds.
- The red and yellow LEDs are lit for 20 seconds (the green LED is off).
- All the LEDs are off for one second.

After this, the self test and initialisation have been completed and the equipment returns to normal operational state.

You can display the possible errors found during the test using the Service Terminal or Macro STE. You can then find more detailed information on the fault in the **Self test** menu.

The test ends automatically if no fatal errors were found.

6.2 Management

ACL2i can be managed through the line connection or local management.

The following items need to be checked:

Q1 transmission speed (Q1: 6,1,1 and 6,1,4)

The Q1 transmission speed needs to be set to match the system management speed.

Q1 address (Q1: 6,1,2)

The equipment needs a Q1 address to be visible in the NMS systems. You must give a unique address to each equipment.

You can also enter a name for the equipment by using the command **4,7,2,1**.

Q1 management path (Q1: 6,1,8...11)

Routing of the management must be defined to correspond with the system.

The following menu setting alternatives are available:

- Data hybrid (**6,1,8**)
- Int Q1 bus (**6,1,9**)
- LMI master (**6,1,10**)
- Q1 via line (**6,1,11**)

Q1 rates 600, 1200, 2400, 4800, and 9600 bit/s are supported.

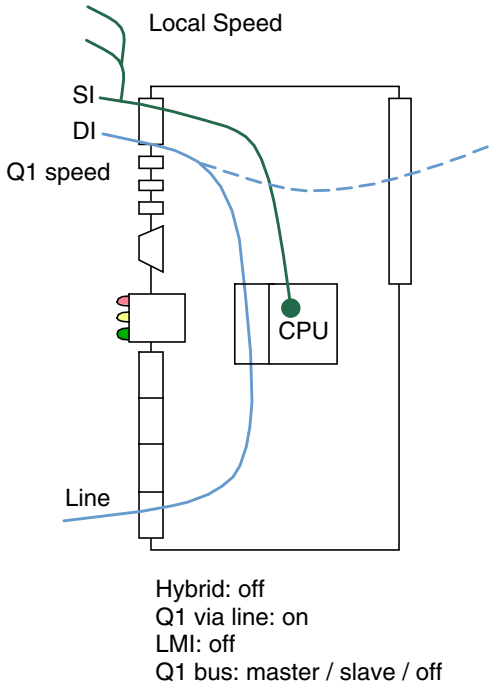


Figure 8. Example of Q1 routing

In this example, management of the equipment is performed through the service interface (SI). The speed of the local management is defined in the **6,1,1** menu option (**Local speed**). In this case, service interfaces can be connected to a bus.

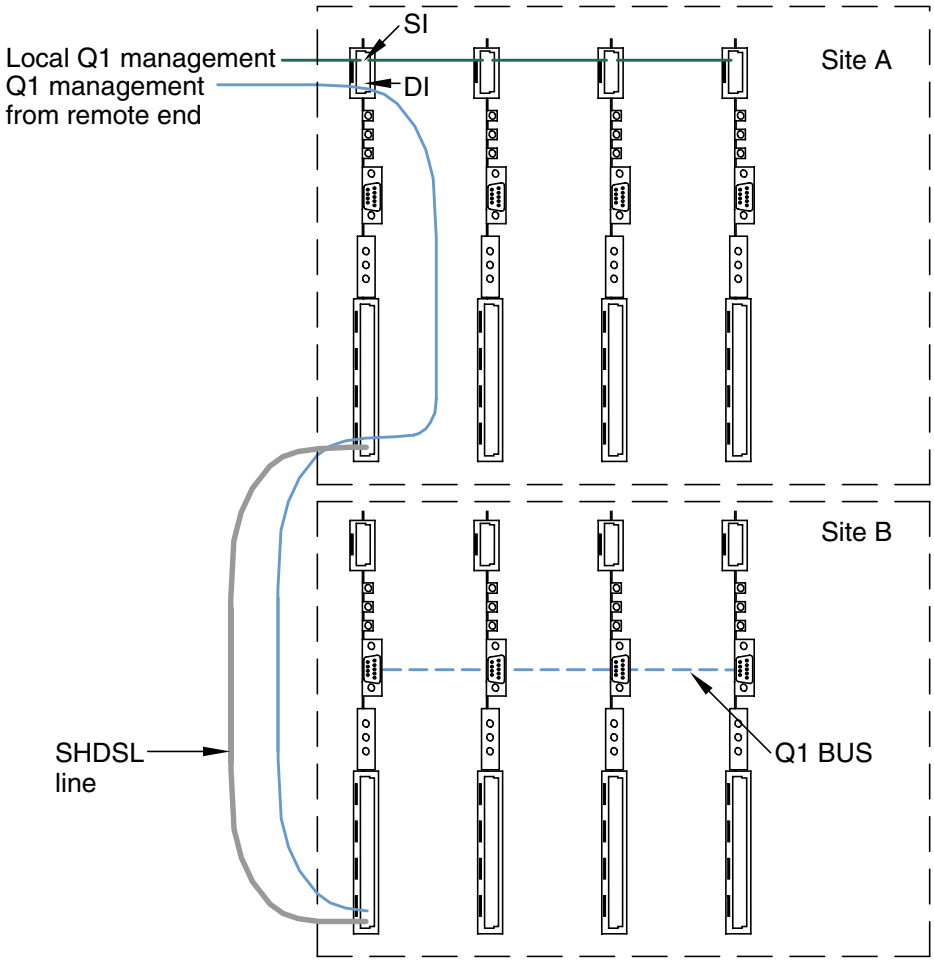


Figure 9. Q1 management data routing

If you want to perform site B management via the line, management data goes through the data interface (DI) and the SHDSL line. The speed is defined in the **6,1,4** menu option.

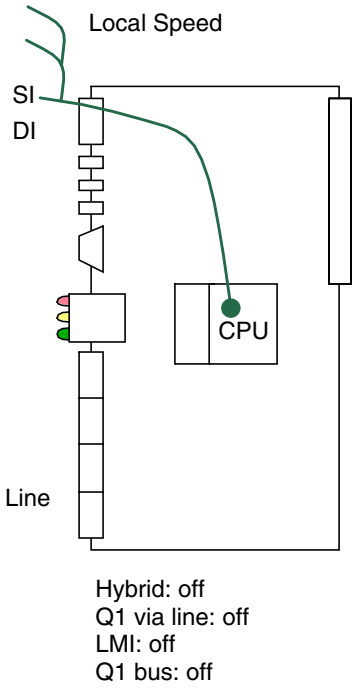


Figure 10. Example of Q1 routing

In this example, management is performed locally. Service interfaces can be connected to a bus, in which case, for example, the whole rack can be managed from the same place.

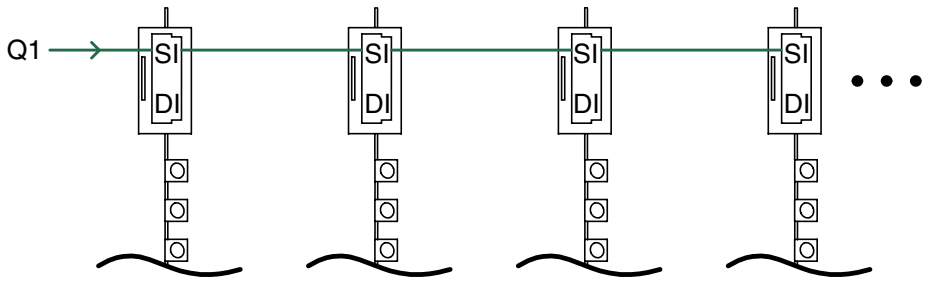


Figure 11. Local management

Management over the line is not possible in this application.

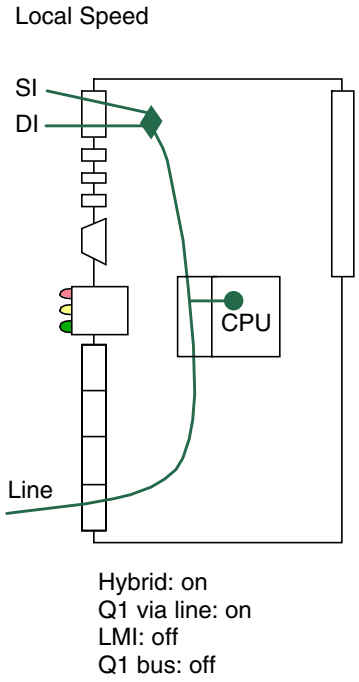


Figure 12. Example of Q1 routing

In this example, local management must be performed either through the backplane bus (Q1 bus: master/slave) or by connecting service and data interfaces to a bus.

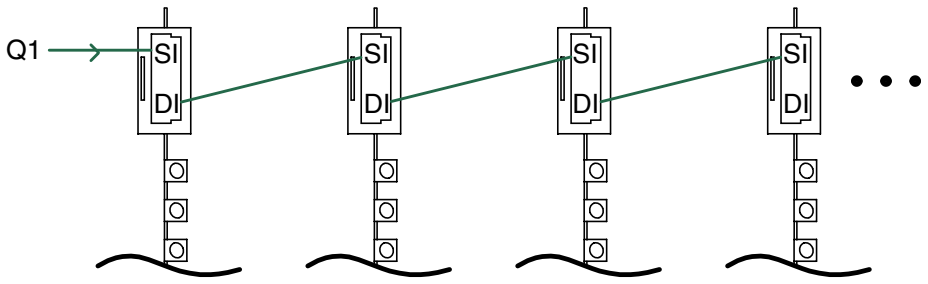


Figure 13. Service and data interfaces connected to a bus

In this case, management data is also transferred over the line to the far end equipment, for example to DNT2Mi.

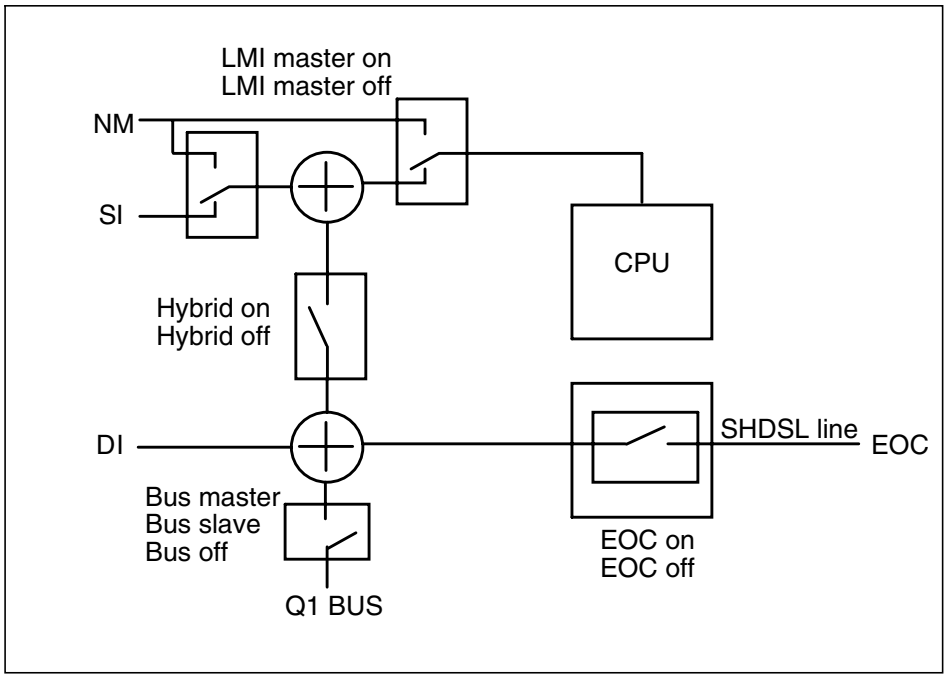


Figure 14. Q1 management routes

Note

The address setting has the following restrictions:

- Address 4095 must not be given if the equipment is connected to an NMS bus. This address is a common (broadcast) address.
- Address 4094 is reserved for PC-TMC/STE use (general address for the PC interface unit).
- Address 0 is reserved for PC-TMC/STE use (default address for the PC interface unit).

6.3 Timing source

Before connecting ACL2i to a network, you need to know how the network is timed.

ACL2i can receive timing information through the line and port interfaces and through the external timing interfaces. ACL2i can also be used as a network timing source using the unit's internal timing circuits.

More information can be found in Section 8.5, 'ACL settings'.

6.4 Line settings

You have to check the following items:

Remote power feed (Q1: 6,3,2)

If there is a repeater in the line or power needs to be fed to the far end equipment, you have to check the remote power feed.

Line interface (Q1: 6,3,3)

Line interface settings determine the line SHDSL mode, connection speed, and use of wires.

Typically, ACL2i is configured as STU-C, in which case you have to define the line rate also. If the configuration is STU-R, the equipment operates in the Rate Adaptive mode and it automatically adapts the requested fixed line rate to STU-C.

Power backoff (Q1: 6,3,6)

Select this option to enable or disable transmit power reduction on short loops.

Line alarms (Q1: 6,3,8 and 6,3,9)

The BER alarm limit and alarm severity have to be checked.

6.5 2M data interface settings

2M data interface settings (Q1: 6,4,1 and 6,4,2)

Check that the 2M data interface settings are compatible with the equipment they are connected to. Note that in the Q1 menus, 2M data interface is referred to as a port interface.

Port alarms (Q1: 6,4,8 and 6,4,9)

You have to check the BER alarm limit and alarm severity.

6.6 Protection settings

Password (Q1: 10,1, 10,2 and 10,4)

ACL2i settings can be protected with a password or PIN signal.

6.7 Measurements

After all the settings have been checked, we recommend that you carry out a line quality and a BER test.

Note

Before starting the BER test, reset all statistics and error counters. Read the statistics and error counters after the BER test.

Noise margins, Rx and Tx line levels, and attenuations (Q1: 7,1...4)

Establish a link between two units. After the line is up, check the noise margin, Rx and Tx levels, and the line attenuation from the **Measurements** menu.

Line voltage (Q1: 7,5)

You can measure the voltage in the line of the remote-powered equipment. The start-up voltage of the remote-powered power supply is 90 V and the minimum voltage to keep the power supply functional is 50 V.

Bit error rate test

In some cases, it is advisable to perform a five-minute bit error rate (BER) test. You do not need to test all line terminals. For the test, you need an external test equipment.

After the tests

Check that all alarms have disappeared and the statistics are still correct.

Monitoring a line		
Tx level Line 1 or 2: xx dBm	xx = +7.5 to +14.5 dBm	
Rx level Line 1 or 2: xx dBm	xx = +14.5 to -26 dBm	
Noise margin Line 1 or 2: xx dB	xx = 0 to +15 dB	Noise margin +15...1 dB, expected BER < 10^{-7} 0 dB, expected BER 10^{-7}
Attenuation Line 1 or 2: xx dB	xx = 0 to 41 dB	

Note

Impulse noise is not taken into account when measuring the noise margin.

Monitoring port statistics	
You can check correctness of the signal both at the port and at the line connection by using the **Statistics** menu.	
Signal quality Last 15 min	Signal quality monitored during 1 period of 15 minutes to max. 100 successive periods of 15 minutes. Q1 menus give you absolute and relative values.
Signal quality Last 24 hours	Signal quality monitored during 1 period of 24 hours to max. 30 successive periods of 24 hours. Q1 menus give you absolute and relative values.

6.8 Factory values

The following default values can be recalled from the Q1 menu path **6,7**.

Note

Recalling of factory settings can take up to 30 seconds.

Global parameters	
Timing source	Transparent
Q1 address	1
Q1 management	Data hydrid: off INT Q1 bus: off LMI master: off Q1 via line: off
Control and test loop limit	10 minutes
Temperature alarm limit and severity	70 ^{o}C and severity no alarm
Local management speed	4800 bit/s
Q1 speed	4800 bit/s
Q1 password for settings	No protection, password: ACL2i
Equipment name	ACL2i

Line parameters	
Line interface	STU-C, 2-wire, line rate 2048 kbit/s
Power backoff	ON
Power feeding	OFF
Bit error alarm limit and severity	10^{-3} and severity B

Port parameters, G.704/2M	
Framing format	No frame
Sa bit usage	Sa4 to Sa8 set to 1
BER alarm limit and severity	10^{-3} and severity B

7 Maintenance

This chapter describes what general information and statistics you can get on the equipment to be monitored. It also deals with possible alarms and faults.

You can access all this information using Q1 menus. The menus are described in detail in Chapter 8.

7.1 Line status LED

On the plug-in unit, there is a two-coloured line status LED indicating the status on the line. Location of the line status LED on the plug-in unit is shown in Figure 5.

Operation of the line status LED

The line status LED operates as follows:

- In two-wire mode:
  - If the line is not connected or the line signal is missing, the LED is lit red.
  - When handshaking is going on (typically about 25 seconds), the LED is flashing green.
  - When the line is up, the LED is constantly green.
- In four-wire mode:
  - If both lines are down (not connected or the line signal is missing), the LED is lit red.
  - If one of the pairs is down and the other one is handshaking, the LED is flashing red/orange.
  - If one of the pairs is up and in the other pair the line signal is missing, the LED is lit orange.
  - If one of the pairs is up and the other pair is handshaking, the LED is flashing green. Also, if both pairs are handshaking at the same time, the LED is flashing green.
  - When both pairs are up, the LED is constantly green.

7.2 Service LEDs

ACL2i has three service LEDs: green, yellow, and red. Operation of these LEDs is described below.

Alarms are indicated with constantly illuminated LEDs as follows:

Red LED

- A serious fault detected in the unit preventing its use.

Yellow LED

- A minor fault detected in the unit restricting its use.
- A fault detected in the signal received by the unit, or
- A control has been initiated in the unit.

Green LED

- The unit is being accessed by a manager unit.

7.3 Alarms

One of the network management's key functions is to collect data on network alarms. Alarms are transmitted via the alarm bus to alarm relays situated in the subrack power adapters. The alarm relays forward alarms A (urgent), B (non-urgent), and D (reminder indication) to the centralised transmission center as rack alarms.

The following three tables (equipment faults, 2M data interface faults, and line interface faults) show how various fault conditions affect the different alarms and interface signalling conditions of ACL2i.

Fault management includes continuous monitoring of equipment status alarm information from the network element database. Faults are shown through the Q1 menu's first option **Fault display** (see Chapter 8).

Table 5. Equipment faults (SB0, Supervision Block 0)

Fault condition	Fault code (h)	TMC/ST alarm	Rack alarm	LED
Loss of remote power supply	03	A	A	red
Test mode (self test)	17	B	B	yel
Fault in equipment	80	AS	B	yel
Local alarm cancel (1)	93	D BD	- -	yel
Sync fault in clock recovery	7c	AS	A	yel
Temperature error (2)	91	A B	A B	yel
(1) With/without alarms present				
(2) Fault category and corresponding signals selected through settings (Q1 menu item **6,3,8 / 6,3,9**). This alarm can be disabled.				

Table 6. 2M data interface faults (SB1)

Fault condition	Fault code (h)	TMC/ST alarm	Rack alarm	LED
Loss of incoming 2M signal	32	AS	A	yel
Loss of frame alignment	51	AS	A	yel
CRC multiframe alignment lost	56	B	B	yel
BER>1E-3 (2)	63	AS A B	A A B	yel yel yel
BER>1E-6 (2)	66	B	B	yel
AIS 2M	42	B	B	yel
Far end alarm (T0 A-bit)	b3	B	B	yel
Loop to interface	15	B	B	yel
(2) Fault category and corresponding signals selected through settings (Q1 menu item **6,3,8 / 6,3,9**). This alarm can be disabled.				

Table 7. Line interface faults (SB2)

Fault condition	Fault code (h)	TMC/ST alarm	Rack alarm	LED
Loss of incoming signal	30	AS	A	yel
Loss of frame alignment	51	AS	A	yel
BER>1E-3 (2)	63	AS A B	A A B	yel yel yel
BER>1E-6 (2)	66	B	B	yel
Far end alarm 1 (3)	b0	B	B	yel
Loop to interface	15	B	B	yel
Unbalance in remote power supply	04	B	B	yel
(2) Fault category and corresponding signals selected through settings (Q1 menu item **6,3,8 / 6,3,9**). This alarm can be disabled. (3) Far end power off (pwf).				

Probable causes for each fault condition of the supervisory blocks are explained in the following sections.

7.3.1 Equipment faults

Loss of remote power supply (03h)

There is a fault in the remote power supply block of ACL2i.

Test mode (17h)

A self test has been run in the equipment.

Fault in equipment (80h)

The unit has detected a possible hardware malfunction during its operation. A self test should be run to verify that the unit is not faulty.

Local alarm cancel (93h)

Pending alarms of the unit have been temporarily cancelled via the Q1 menus of the unit.

Sync fault in clock recovery (7ch)

This fault initiates from three conditions:

a. The timing source of the unit is Port and the Rx timing signal is not present at the port interface.

b. The timing source of the unit is Line and there is a 'Loss of signal' condition at the SHDSL line interface.

c. External timing signal is missing.

Temperature error (91h)

Temperature in the subrack where ACL2i is installed has exceeded the defined limit.

7.3.2 2M data interface faults

Loss of incoming 2M signal (32h)

There is a loss of the G.703 signal in the port interface.

Loss of frame alignment (51h)

There is a loss of the G.704 basic frame.

CRC multiframe alignment lost (56h)

CRC-4 multiframe alignment is lost or cannot be found but the basic frame alignment is ok.

BER>1E-3 (63h)

The bit error rate in the receive direction of the G.704 line has been exceeded or is approaching 10^{-3}. The value is an approximation.

BER>1E-6 (66h)

The bit error rate in the receive direction of the G.704 line has been exceeded or is approaching 10^{-6}. The value is an approximation.

AIS 2M (42h)

AIS information received in the G.703 interface.

Far end alarm (B3h)

A far end alarm from the remote end is received through the T0 A-bit of the frame structure on the G.704 line. This means that there is an internal fault condition or a synchronisation problem in the remote end unit.

Loop to interface (15h)

A loopback towards the G.703 interface has been activated in the unit by using the Q1 menus.

7.3.3 Line interface faults

Loss of incoming signal (30h)

There is a 'Loss of signal' condition according to the SHDSL recommendation at the SHDSL line interface.

Loss of frame alignment (51h)

There is a 'Loss of SHDSL framing' condition according to the SHDSL recommendation at the SHDSL line interface.

BER>1E-3 (63h)

The bit error rate in the receive direction of the SHDSL line has been exceeded or is approaching 10^{-3}. The value is an approximation.

BER>1E-6 (66h)

The bit error rate in the receive direction of the SHDSL line has been exceeded or is approaching 10^{-6}. The value is an approximation.

Far end alarm 1 (B0h)

A 'Power off' condition indication of the remote SHDSL unit has been received through the PS-bits of the SHDSL line's frame structure. For some reason, the remote unit has been disconnected from the mains voltage.

Loop to interface (15h)

A loopback towards the SHDSL interface has been activated in the unit by using the Q1 menus.

Unbalance in remote power supply (04h)

A failure situation noticed in the remote power supply (for example overcurrent).

7.4 Checking measurements and statistics

Measurements and statistics to be checked through the Q1 measurements cover various quality parameters, line and error counters.

The parameters that can be viewed through the Q1 menus **Measurements** (main menu branch **7**) and **Statistics** (main menu branch **8**) are listed below.

ACL measurements via Q1 menus

- Noise margin
- Rx level
- Tx level
- Line attenuation
- Line voltage (remote-powered)

ACL statistics via Q1 menus

Signal qualities of the selected 15-minute periods (max. 100 periods) and 24-hour periods (max. 30 periods) and since the last reset, according to Rec. G.826, are indicated by the quality parameters in Table 8.

Table 8. Statistics values via Q1

Information	Abbreviation and/or ratio	Description
Total time	TT	Time passed since the last reset.
Unavailability time	UAT (Rx, Tx)	Ten consecutive SES seconds increases the UAT value.
Errored seconds	ES (Rx, Tx)	Number of errored seconds.
Severely errored seconds	SES (Rx, Tx)	Number of seconds during which ≥ 30% blocks are errored.
Background block errors	BBE (Rx)	Number of errored blocks, except blocks during severely errored seconds and unavailable time. The block size depends on the used line rate.
Unavailability time ratio	UATR (Rx, Tx)	Ratio of unavailability time to the total time during the last 15 minutes or 24 hours.

Table 8. Statistics values via Q1 (Continued)

Information	Abbreviation and/or ratio	Description
Errored seconds ratio	ESR (Rx, Tx)	Ratio of errored seconds to the total of seconds in the available time during the last 15 minutes or 24 hours.
Severely errored seconds ratio	SESR (Rx, Tx)	Ratio of severely errored seconds to the total of seconds in the available time during the last 15 minutes or 24 hours.
Background block error ratio	BBER (Rx)	Ratio of background block errors to the total of blocks during the last 15 minutes or 24 hours, except blocks during severely errored blocks and unavailable time.

System counters via Q1

- Number of CPU resets and the time passed since the last reset.

7.4.1 Tx level

Transmission level is from +7.5 dBm to 14.5 dBm. If the power backoff function is set **ON**, the transmission level (13.5 or 14.5 dBm) is reduced by one to six dB on short line lengths, if necessary.

7.4.2 Rx level

Received level can vary between 14.5 dBm and -26 dBm depending on the line length and the transmission level of the opposite end.

7.4.3 Line attenuation

Line attenuation can be from 0 dB to 41 dB. Its value depends on the line length and cable characteristics.

7.5 Testing

ACL2i can be tested through a self test and test loops. The self test is initiated through the **Testing** menu (Q1 menu **9**) and test loops are initiated through the **Controls** menu (Q1 menu **5**).

7.5.1 Self test

This test is used to check the operation of the unit. It is an extensive internal test that covers most of the equipment excluding the DTE and line interfaces. During the test, the unit can not be reached by a manager unit. The test also inhibits normal data transfer during it. The red and yellow LEDs are lit during the test.

To activate the self test, use the Q1 menu option **9,2**.

7.5.2 Test loops

Test loops include a port interface loopback and a line interface loopback. Loopbacks are set into operation via the management interface.

To activate the test loops, use the Q1 menu option **5,2,2** or **5,3,2**. The loops are deactivated after a fixed monitoring time (Q1 menu option **6,1,7**). The loops can also be deactivated with the Q1 menu option **5,2,1** and **5,3,1**.

2M data interface loopback

By using the **5,2,2** menu option, you can connect the regenerated interface signal from the 2M data interface back to the 2M data interface as an outgoing signal. This loopback can be used, for instance, for examining the data signal cabling.

When the loopback is active, AIS is sent to the line via the line interface. It is a sign to other parts of the transmission system that the unit is in an abnormal state.

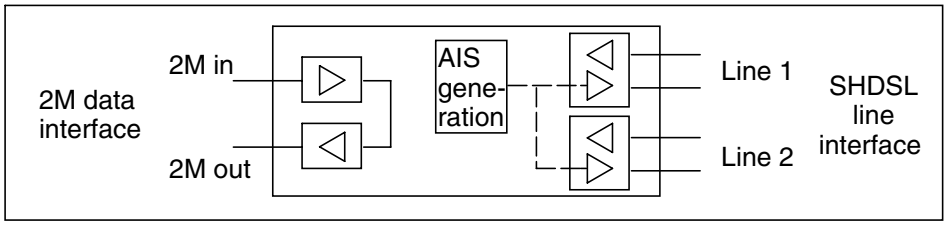


Figure 15. 2M data interface loopback

Line interface loopback

The regenerated interface signal from the line interface is connected back to the line interface as an outgoing signal. The line loopback is used for examining the line interface and the line.

The loopback is executed according to a control coming via the service interface. When the line loopback is active, AIS is sent to the 2M data interface.

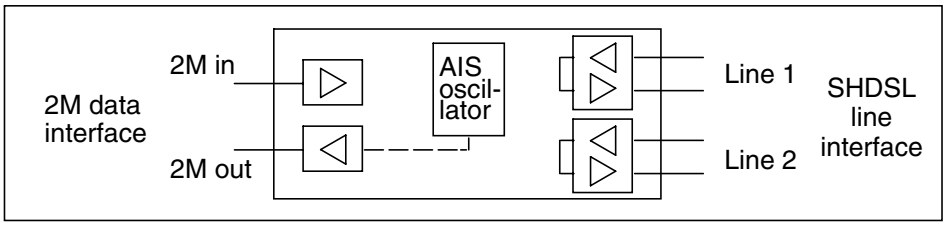


Figure 16. Line interface loopback

8 Using Q1 menus

This chapter describes the Q1 menu system of the ACL2i line terminal.

8.1 General

Figure 17 illustrates the main menu with the first sublevel alternatives. The rest of the menu is presented on pages thereafter.

Different menu options are identified with number series indicating the exact location of the option in question. For example, entry **6,1,5** is on the second submenu level of the **ACL Settings** menu (**6**). These number series are used for direct access to the desired options.

Access to the Q1 menus of ACL2i is provided through the Service Terminal, Macro STE, or Network Management System (NMS). Use of these control devices is explained in their own documentation, whereas the ACL2i customer documents concentrate on functions of the network terminal itself.

The Q1 main menu level contains the following 11 menus, of which those available in ACL2i are typed in boldface in the list below:

1. **Fault display**
2. **Local alarm cancel**
3. **Reset local cancel**
4. **Identifications**
5. **Controls** *(temporary)*
6. **Settings** *(permanent)*
7. **Measurements**
8. **Statistics**
9. **Testing**

10. **User privileges**

11. Miscellaneous

The options of the ACL2i menus are described in more detail in the following subsections.

8.2 Menu diagrams

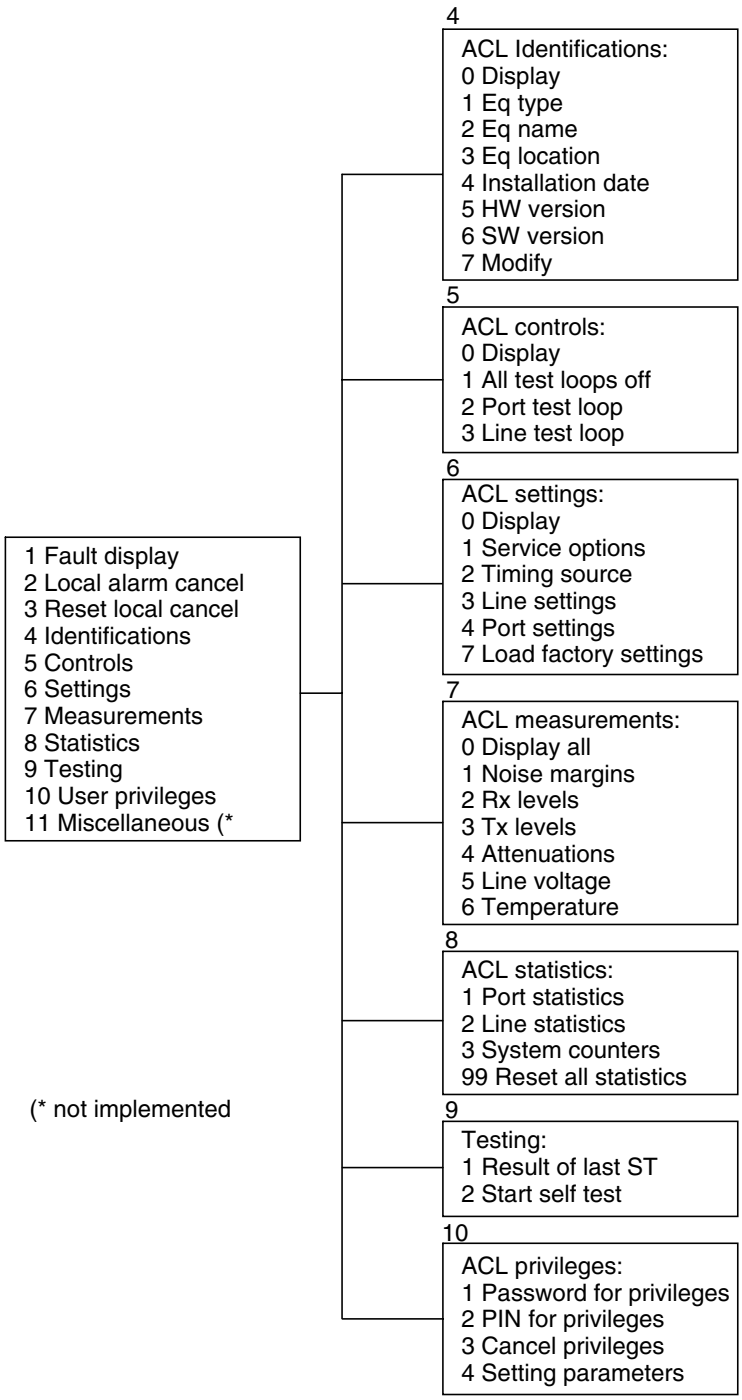


Figure 17. Main Q1 menu structure

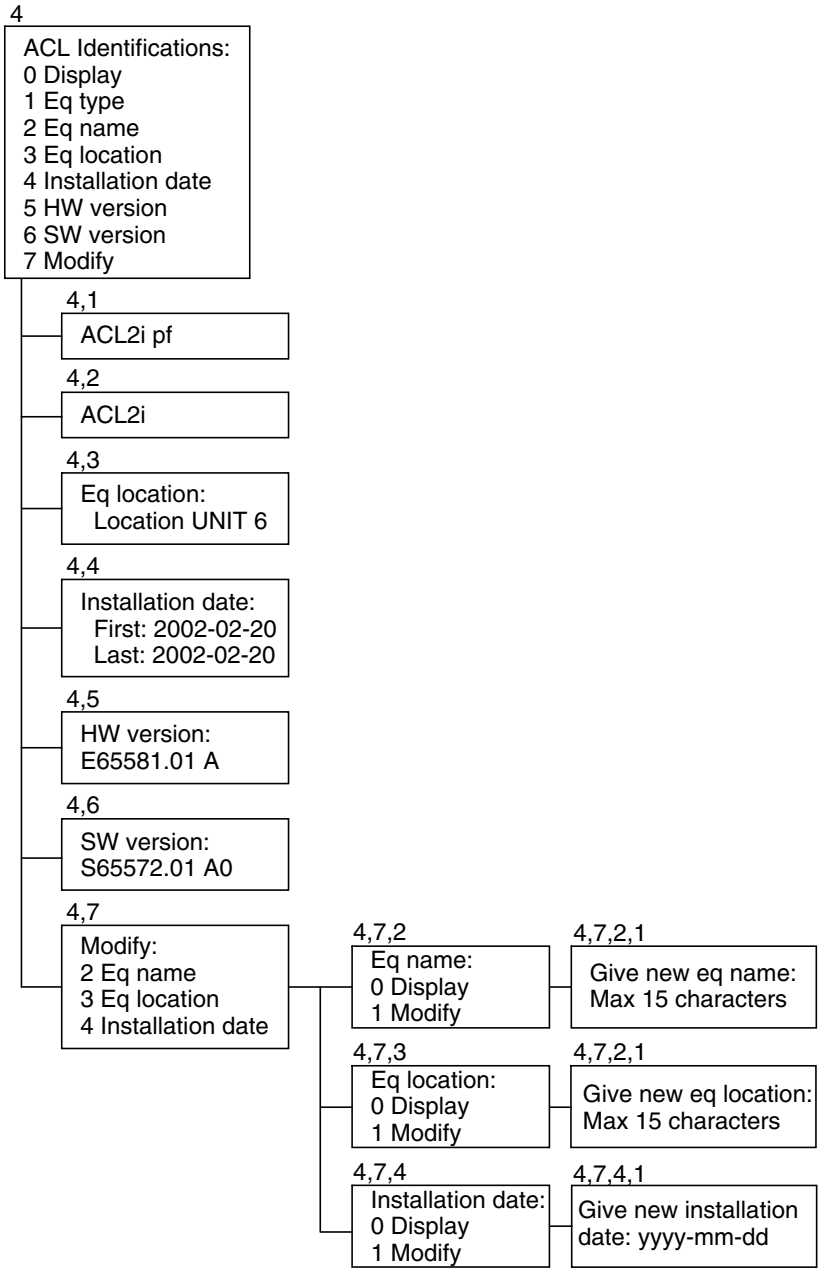


Figure 18. Identifications menu

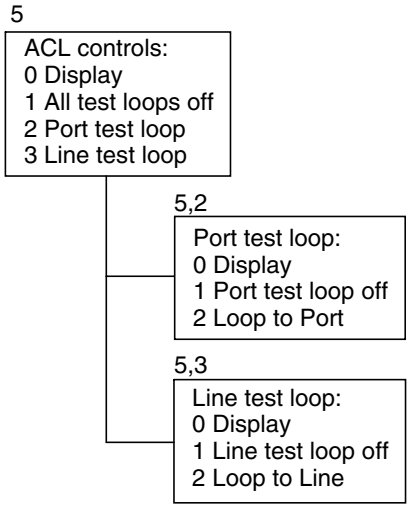


Figure 19. Controls menu

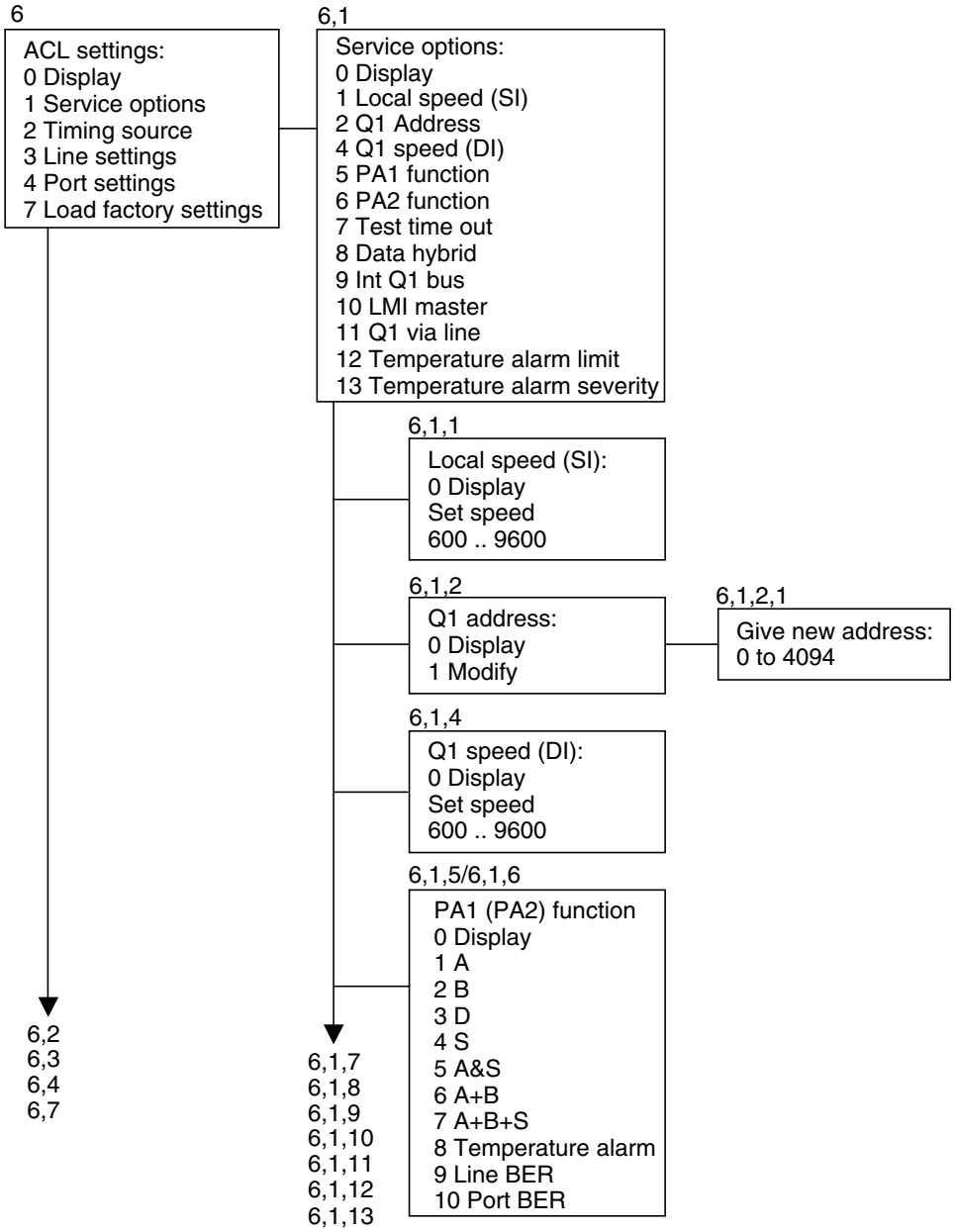


Figure 20. Settings menu structure

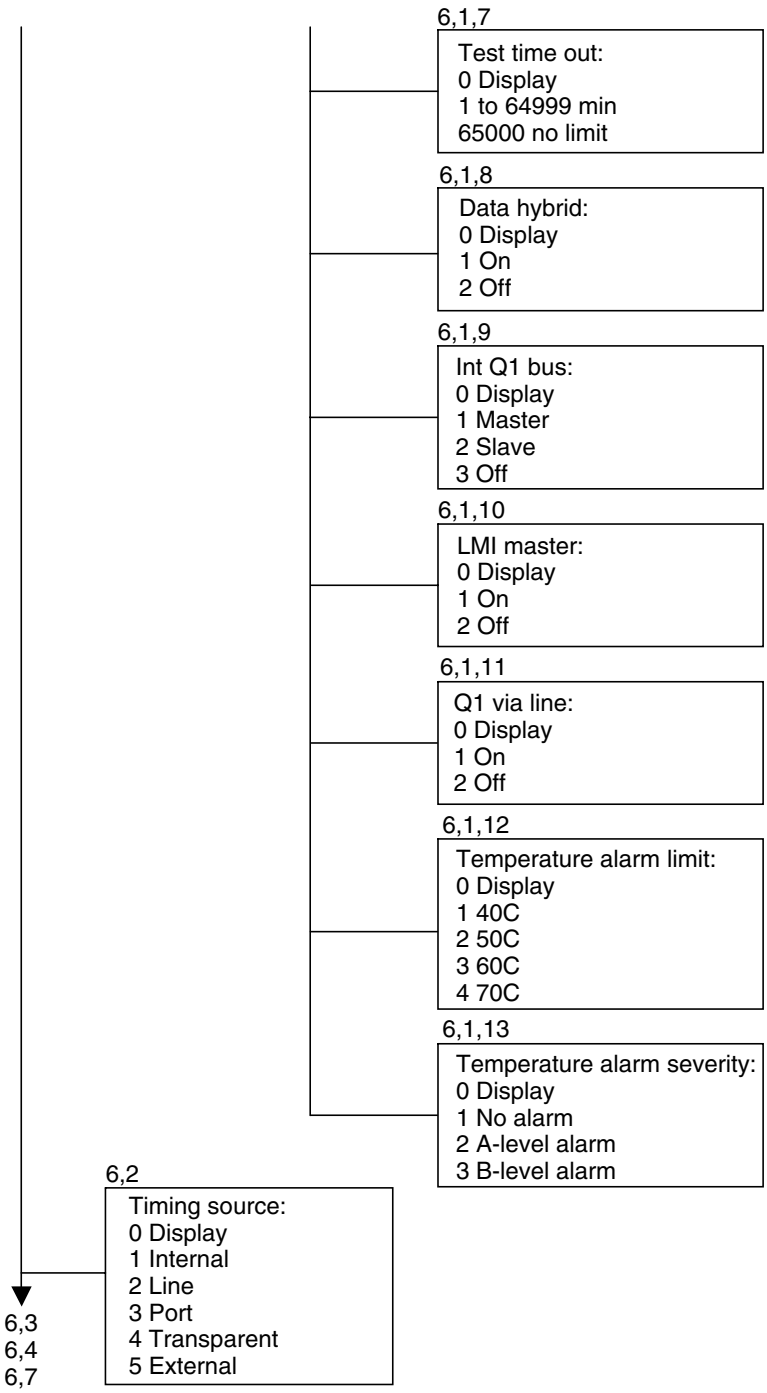


Figure 21. Settings menu structure (continued)

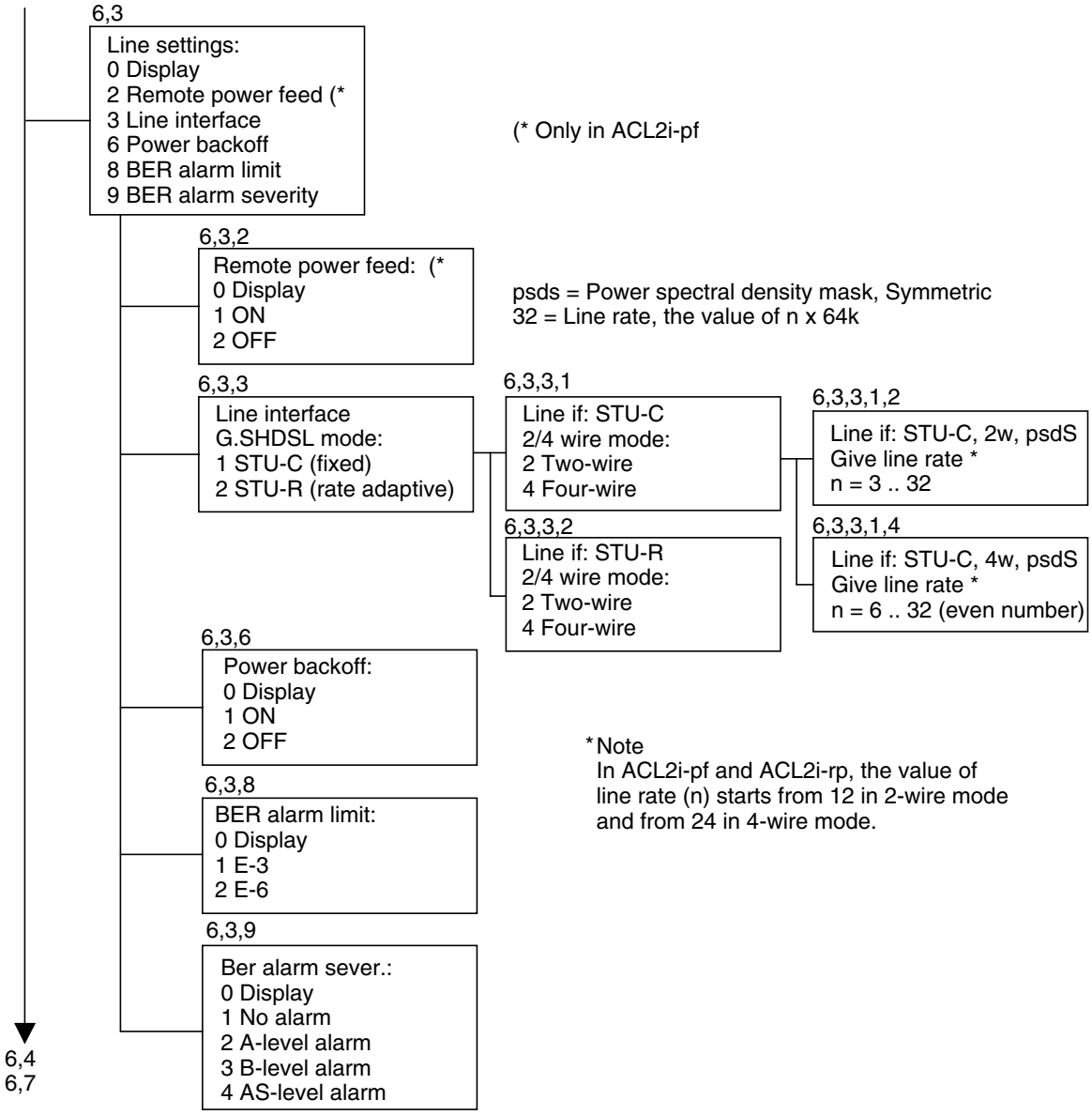


Figure 22. Settings menu structure (continued)

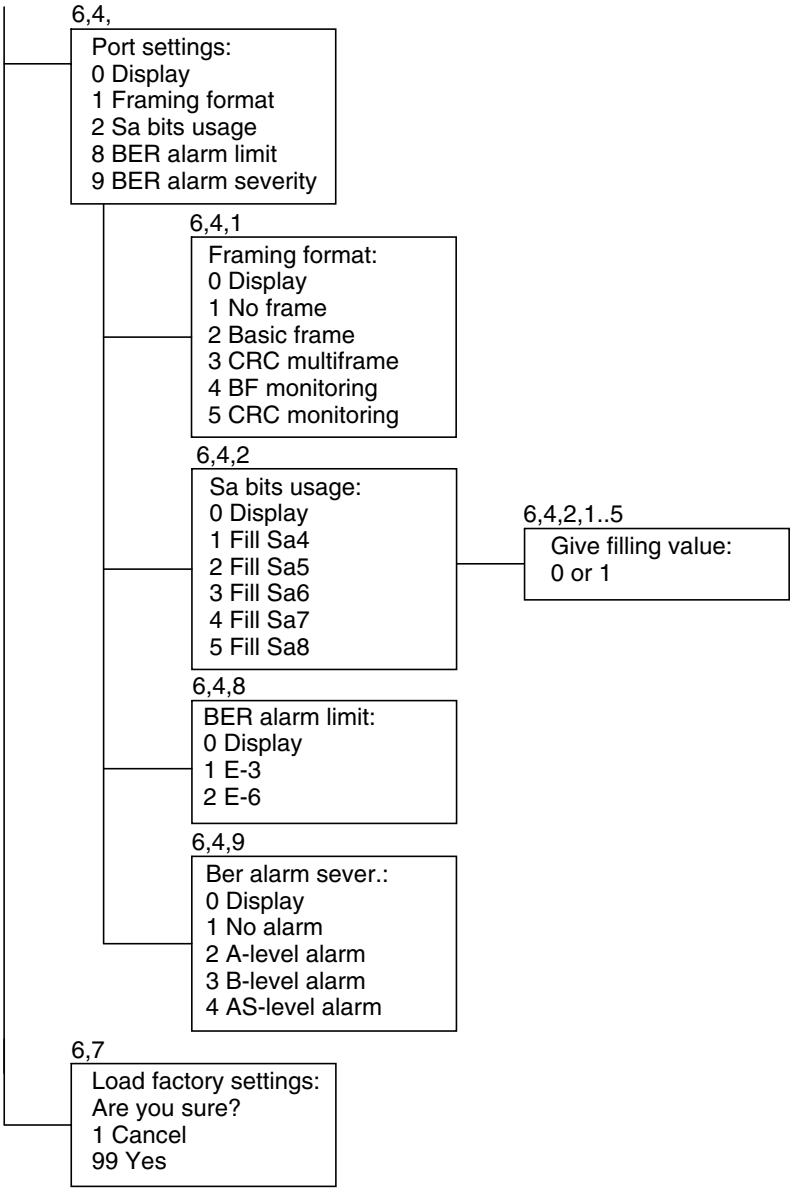


Figure 23. Settings menu structure (continued)

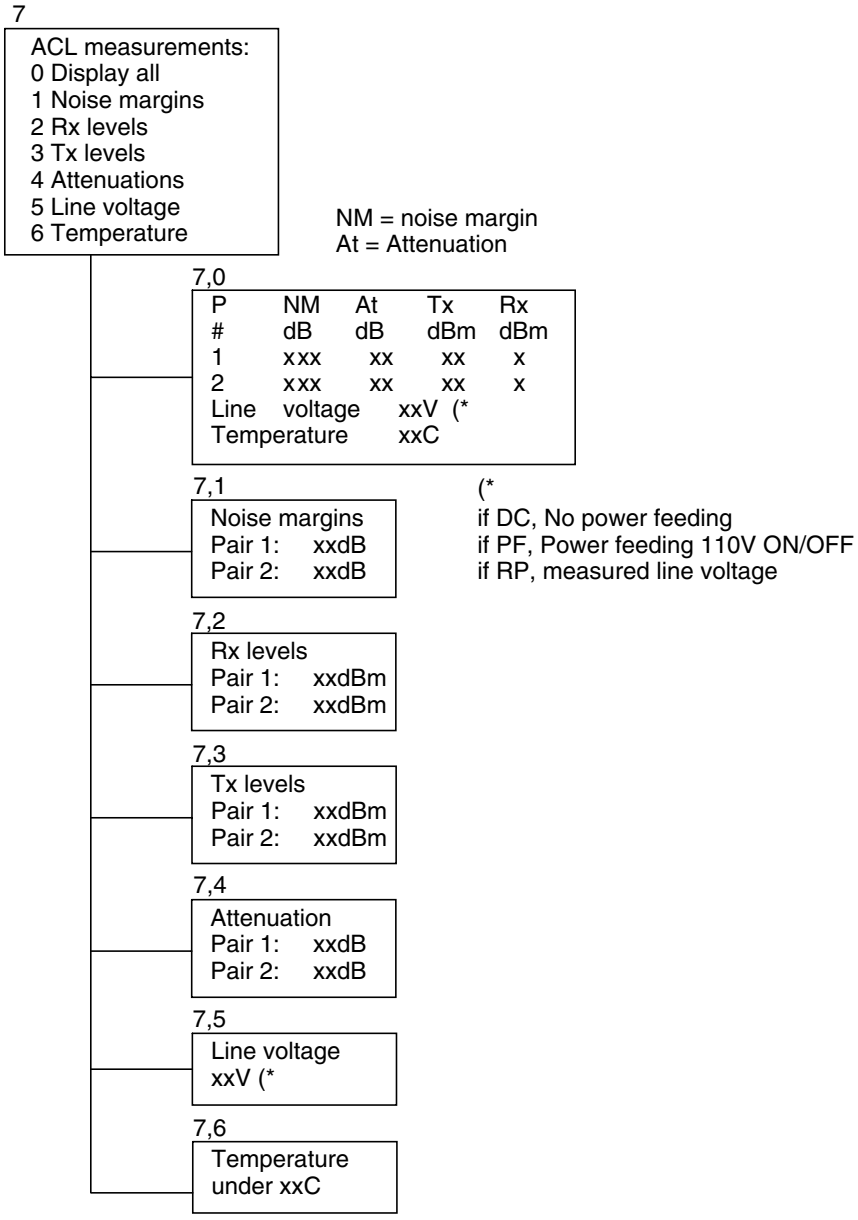


Figure 24. Measurements menu

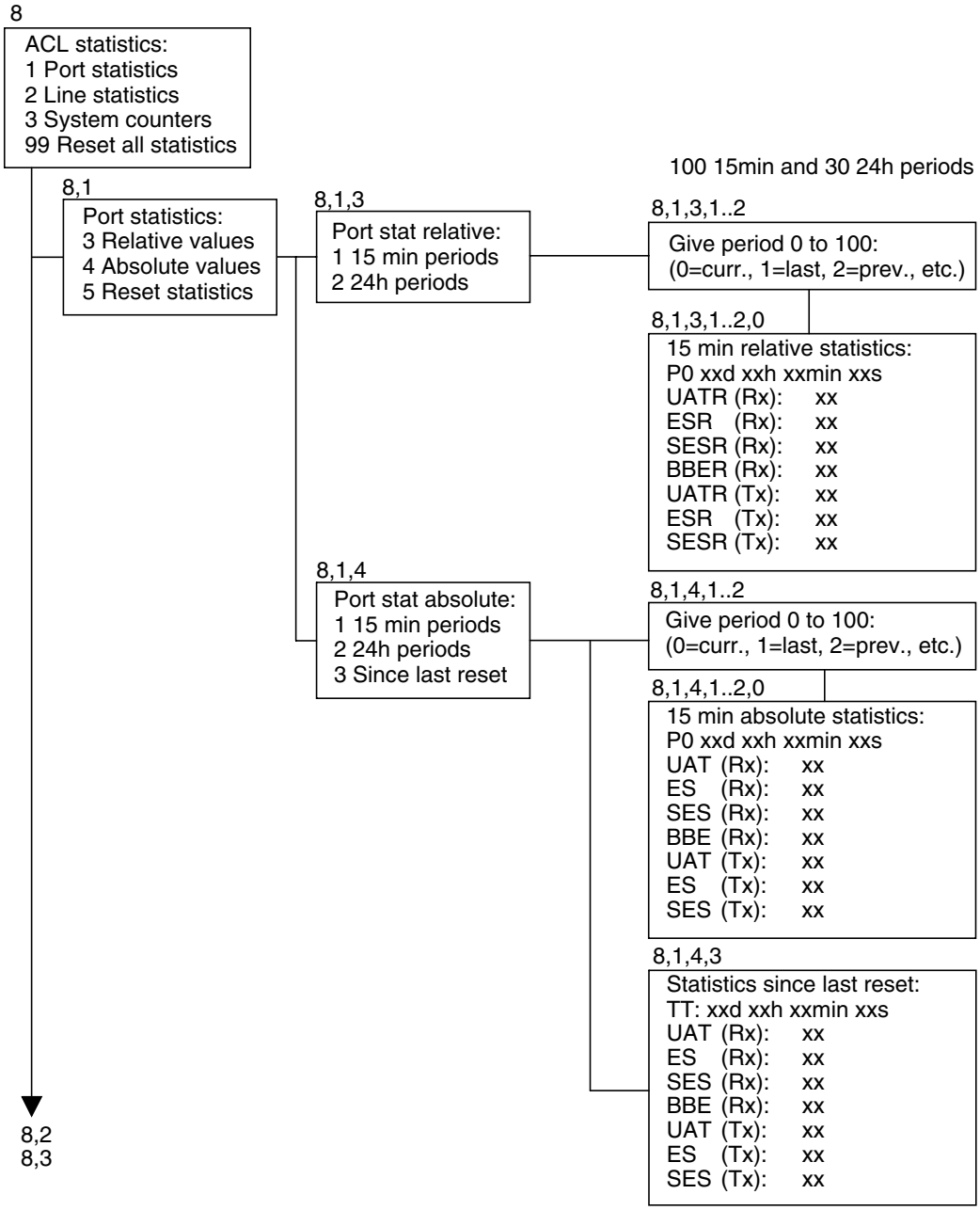


Figure 25. Statistics menu structure

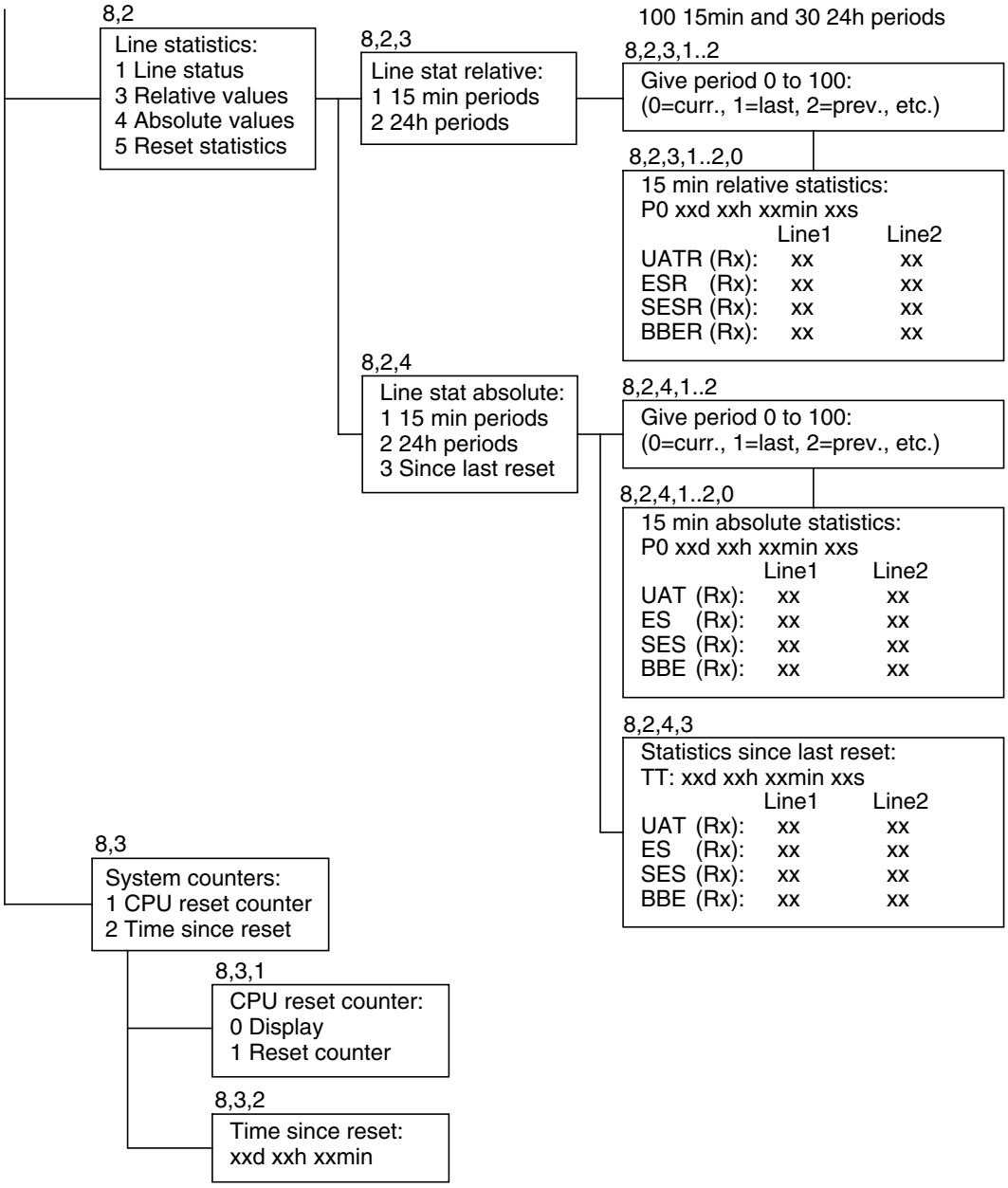


Figure 26. Statistics menu structure (continued)

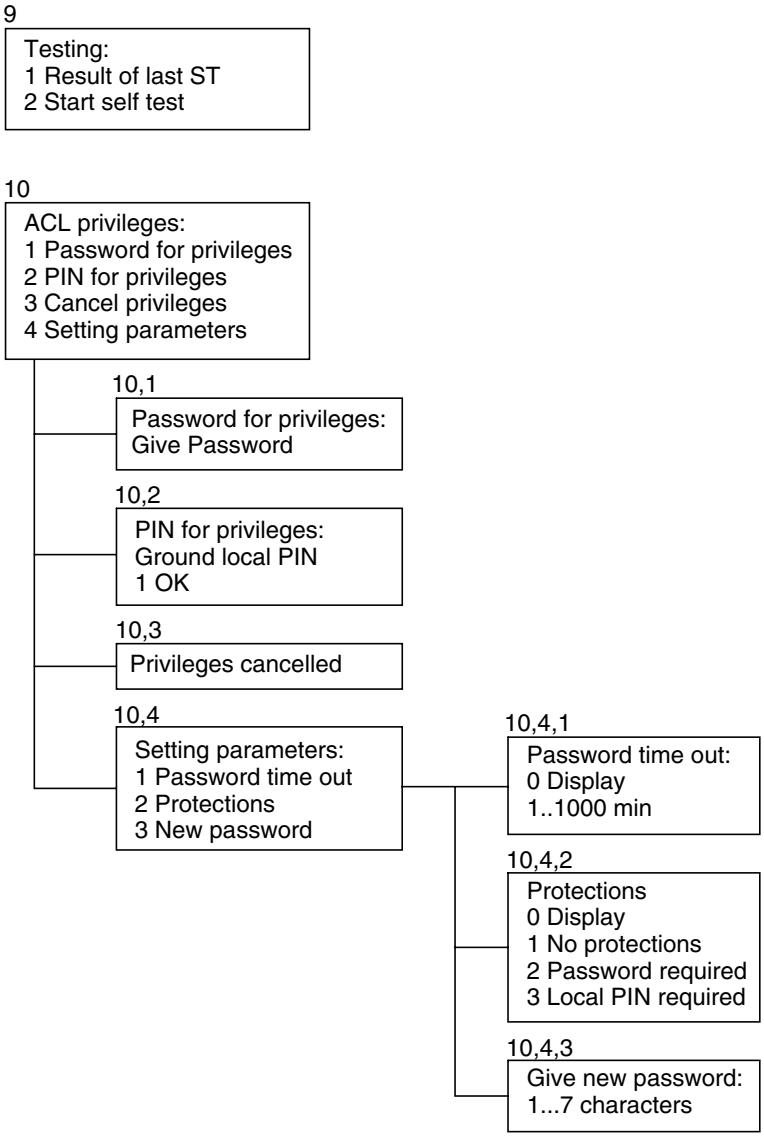


Figure 27. Testing and Privileges menus

8.3 ACL identifications (4)

This menu branch allows you to check the identification information of the ACL2i line terminal. You can display every identification separately or all identications by using the **4,0 Display** menu option.

An example of identification display:

```
Equipment type:
 ACL2i pf (T65580)
Equipment name:
 D 206
Equipment location:
 Location UNIT 21
Installation date:
 First: 2002-08-01
 Last: 2002-11-25
HW:
 E65581.01 A
SW:
 S65572.01 A0
```

You can also display separately every identification needed for identifying the equipment. These identifications are:

- Type of the ACL2i terminal (**4,1**)
- HW and SW version (**4,5** and **4,6**)
- Name of the equipment/installation location (**4,2/4,3)**
  - You can modify the name by using the **4,7** menu option.
- Date of the first installation
  - When you give the date for the first time (**4,4**), it will be saved as the first and the last installation date. An example:

```
Installation date:
First: 2002-07-25
Last: 2002-07-25
```

  - Next installation dates are allways saved as the last installation date. An example:

```
Installation date:
First: 2002-07-25
Last: 2002-12-01
```

The location of the equipment consists of a user-provided ID and a hardware-provided unit number that indicates the position of the unit in the rack.

The **Equipment name** and **Equipment location** can be modified by typing in an ASCII string of 15 characters (max.). The installation date is given in the following format: YYYY-MM-DD.

8.4 ACL controls (5)

Test loops of the ACL2i terminal can be activated through this menu. The controls available have the following common features:

- They have a default value which is overridden or restored through this menu.
- The default value is automatically restored after a given timeout, which can be set through the **Settings** (**6**) submenu.
- The default value is restored (**6,1,7**) if power is removed from the unit.

Each interface can be separately set for the normal or loopback operation, see Figures 15 and 16.

The **Display** option shows the state of the control operation.

Having selected the **5,2 Port test loop** option, you will find a submenu that specifies the control function (**Loop to Port**).

Having selected the **5,3 Line test loop** option, you will find a submenu that specifies the control function (**Loop to Line**).

The **ACL controls** menu has also the **5,4 Self test** submenu, which shows the result of the last self test and enables activation of a self test. The result of the self test can be read after the unit has performed the whole test. The test takes about 20 seconds.

Caution

Activation of a self test cuts the management and the data connection.

Note

If the main system clock is generated from the line interface (see **Timing Source** (**6,2,2**)), internal clock is used during the port looped state which causes a synchronisation fault to be shown by the **Fault display** (see section 7.3).

8.5 ACL settings (6)

This alternative displays the main level of the **Settings** menu.

Display (6,0)

Provides a list of states of all the settings under item **6**.

```
Local speed (SI): 4800
Q1 address: 1
Q1 speed (DI): 4800
Control timeout: 10 min
Timing source: Transparent
Line interface:
 PSD symmetric
 2-wire
 Line rate n=32 (2048k)
 STU-C
Power backoff: On
RPF: Off
Port: No frame
National bits: 11111
PA1: A+B+S
PA2: D
Data hybrid: Off
Int Q1 bus: Off
LMI master: Off
Q1 via line: Off
Temperature alarm:
 Limit: 70C
 Severity: No alarm
Port BER alarm:
 Limit: E-3
 Severity: B-level
Line BER alarm:
 Limit E-3
 Severity: B-level
```

The states of the settings in the display above are factory settings.

8.5.1 Service options (6,1)

The options are listed in the menu under branch **6,1**.

Local speed (6,1,1)

This alternative is used for setting the management data rate between ACL2i and the management equipment connected to the SI port. The speeds 600, 1200, 2400, 4800, and 9600 bit/s can be selected. The factory default is 4800 bit/s.

Q1 address (6,1,2)

An individual address is set for the equipment so that it can be used on the Q1 bus. The address value is between 0 and 4093.

For the restrictions in address usage, refer to the Note at the end of Section 6.2.

Q1 speed (6,1,4)

This option defines the management data rate used between the DI port and the EOC/Bus in a case when the hybrid is configured off. Otherwise, the configured local speed value is dominant.

PA1 and PA2 functions (6,1,5 and 6,1,6)

These menus are used for selecting a function of the programmable alarm outputs PA1 and PA2.

Menu options activate the alarm outputs PA1 and PA2 when a specified alarm condition is present in the equipment. Alarms A (urgent), B (non-urgent), D (reminder), S (service alarm), or a combination of these can be selected.

The A&S condition indicates the presence of A and S alarms combined, whereas A+B and A+B+S conditions indicate the presence of *any* of the respective alarms in the unit.

Test timeout (6,1,7)

This menu allows you to set the time during which a control (see menu **5,2**) is active. If you do not deactivate an ongoing control yourself, the unit goes automatically back to normal state after the specified time. The timeout is specified in minutes (1 to 64999), but it can also be set to infinite by the menu option **6,1,7** (65000 meaning infinite).

Data hybrid (6,1,8)

The data hybrid of ACL2i can connect the SI interface to the DI interface. This command is used in conjunction with the **INT Q1 bus** selection. When the hybrid is **ON**, data from and to the SI channel is connected to the DI data channel. The ON state enables also the use of the backplane Q1 bus (off/master/slave).

Int Q1 bus (6,1,9)

ACL2i can be configured to be a bus master or a bus slave in relation to the rack's Q1 management bus.

LMI master (6,1,10)

You can set a V.28 type interface as the only local management interface by setting the LMI master **ON**.

Q1 via line (6,1,11)

If the **Q1 via line** option is in **On** state, ACL2i can send management data to the other end of the SHDSL line. It is possible to use all Q1 speeds from 600 to 9600 bit/s.

Temperature alarm limit (6,1,12)

This menu allows you to set a limit for the temperature, exceeding of which causes an alarm to be given. The temperature sensor is located in the upper right corner on the PCB and its accuracy is ±5 °C.

Temperature alarm severity (6,1,13)

With this menu, you can define the severity of the alarm which is given in the case of exceeding the set temperature limit.

The options are:

- No alarm (**6,1,13,1**)
- A-alarm (**6,1,13,2**)
- B-alarm (**6,1,13,3**).

8.5.2 Timing source (6,2)

This option allows you to select the source of the main clock for the whole data transmission.

The ACL2i – ACL2i timing is shown in Figure 28.

The ACL2i – DNT2Mi timing is shown in Figure 29.

- When the **Line** option is selected, the main system clock is generated from the Rx clock provided by the line interface.
- When the **Port** option is selected, the main system clock is generated from the Rx clock provided by the port interface.
- When the **Internal** option is selected, the main system clock is generated from the unit's internal (114) clock.

- When the **Transparent** option is selected, both transmission directions are synchronised from the incoming signal. This option is used in mesh-network solutions.
- When the **External** option is selected, the main system clock is generated from the external clock interface signal and a more jitter-free clock signal can be given (compared to the **Port** option) for the SHDSL connection.

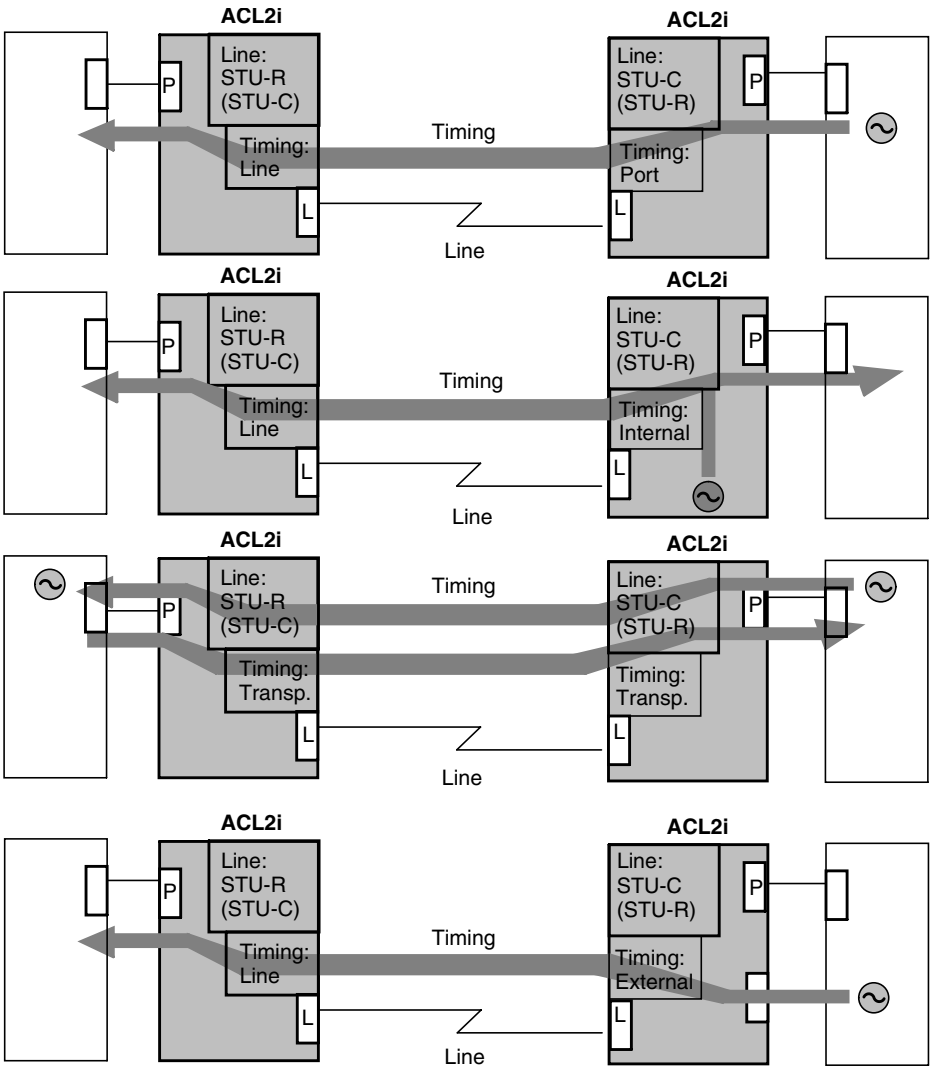


Figure 28. ACL2i – ACL2i timing

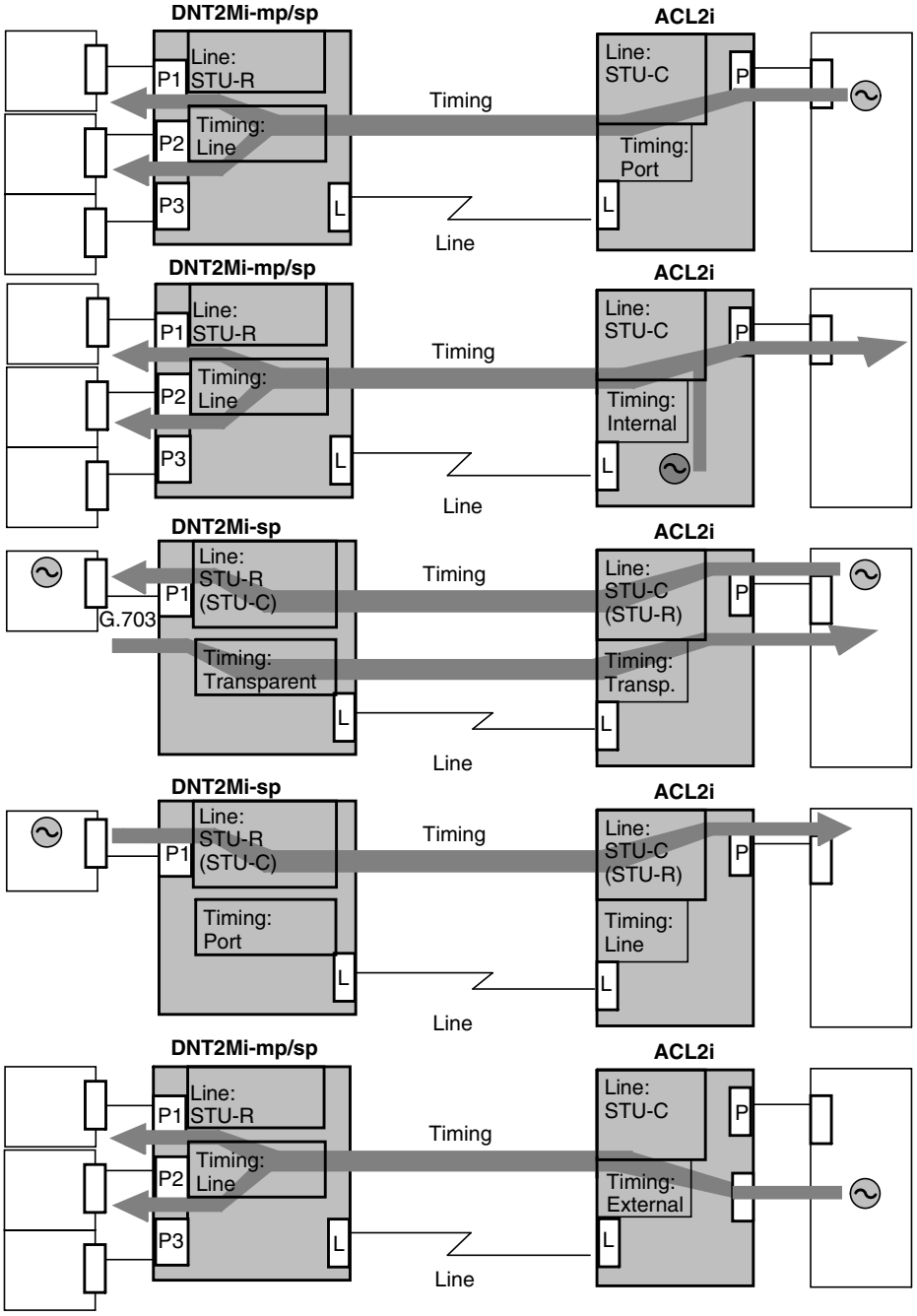


Figure 29. ACL2i – DNT2Mi timing

8.5.3 Line settings (6,3)

This menu branch allows you to perform settings to the line.

Line interface (6,3,3)

In this menu, you can select the following line settings:

- SHDSL mode
- 2-wire or 4-wire mode
- Line rate.

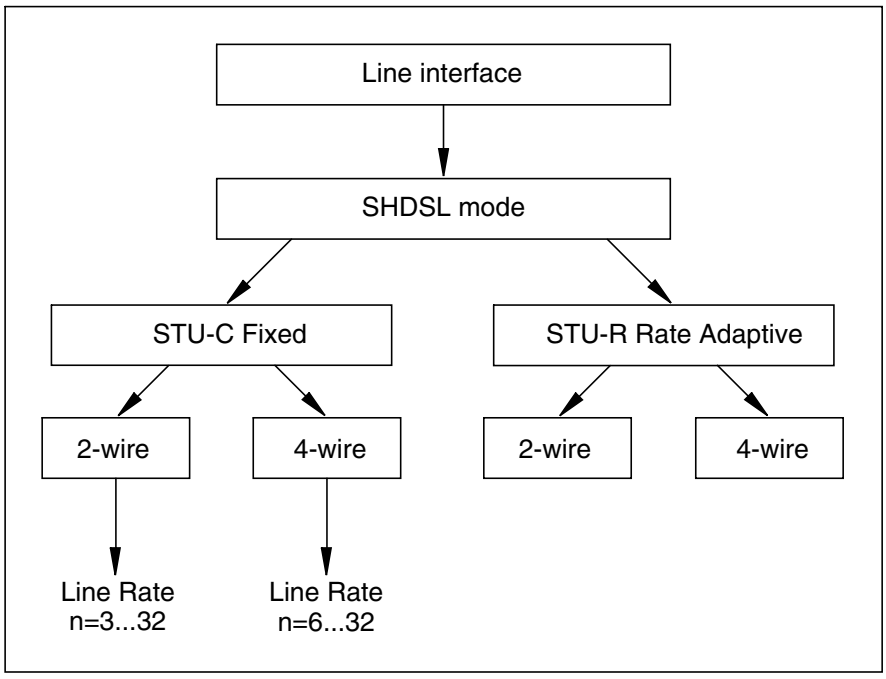


Figure 30. Principle of the Line interface menu

G.SHDSL mode (6,3,3)

This menu allows you to select the SHDSL mode.

STU-C (6,3,3,1)

This option defines the unit as a SHDSL Termination Unit (STU) Central office. It also sets the bit rate in the line as **Fixed**. STU-C determines the line rate to the value given with the menu command **Give line rate (6,3,3,1,2)**.

STU-R (6,3,3,2)

This option defines the unit as a SHDSL Termination Unit (STU) Remote. It also sets the bit rate in the line as **Rate adaptive**. If line conditions (attenuation/noise) allow, STU-R adapts to the line rate set on the STU-C side.

Two-wire (6,3,3,1,2)

In the **2-wire** option, only Line 1 is enabled. Line 2 is idle. See Table 2 for line connector pins.

Four-wire (6,3,3,1,4)

In the **4-wire** option, both lines (Line 1 and Line 2) are enabled. See Table 2 for line connector pins.

PSD mask: Symmetric

The symmetric PSD mask defines the spectral shape of the signal transmitted to the line. The symmetric PSD is in use for both 2- and 4-wire modes (G.991.2 Annex B).

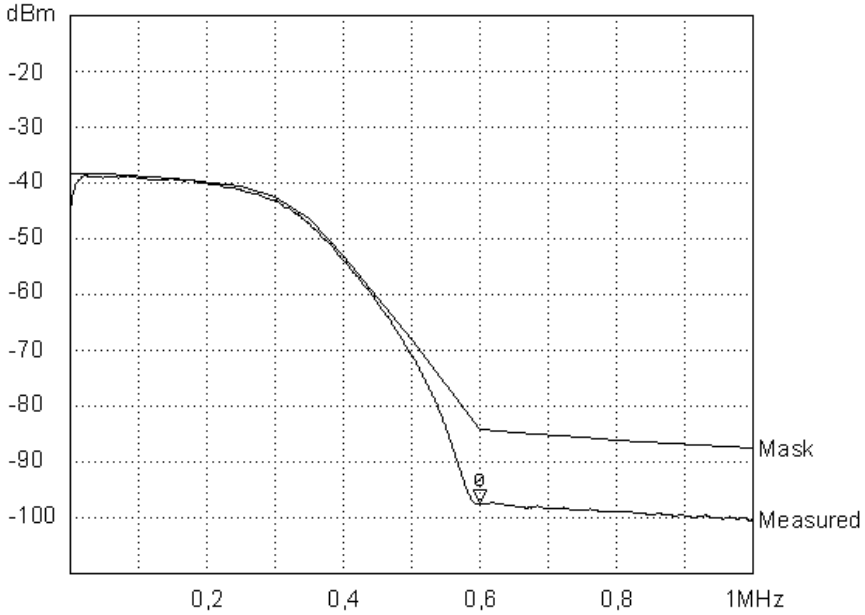


Figure 31. Measured SHDSL symmetric PSD and mask; 2-w, line rate n=32

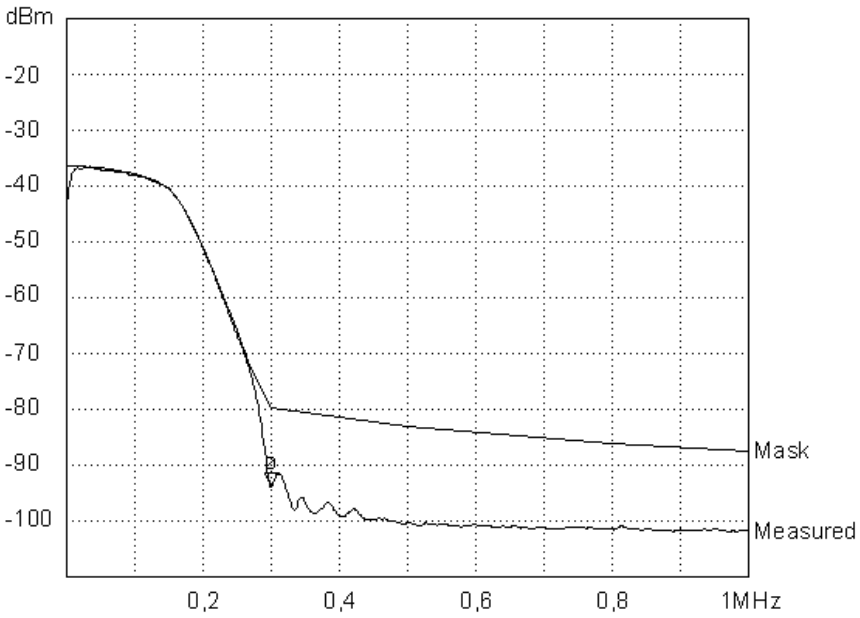


Figure 32. Measured SHDSL symmetric PSD and mask; 4-w, line rate n=32 or 2-w, line rate n=16

Give line rate (6,3,3,1,2,n; 6,3,3,1,4,n)

This setting defines the maximum achievable bit rate in the line only if the **STU-C** option is taken into use.

In the **4-wire** mode, only even numbers for **n** are allowed (n = 6, 8, 10...32).

Note

In ACL2i-pf and ACL2i-rp, the value of the line rate (n) starts from 12 in 2-wire mode and from 24 in 4-wire mode.

Power backoff (6,3,6)

ON (6,3,6,1)

Select this option to enable transmit power reduction on short loops. The transmit power is reduced as a function of the line power loss shown in Table 9.

Table 9. Function of the line power loss

Power loss (dB)	Power backoff (dB)
PL > 6	0
6 ≥ PL > 5	1
5 ≥ PL > 4	2
4 ≥ PL > 3	3
3 ≥ PL > 2	4
2 ≥ PL > 1	5
1 ≥ PL > 0	6

OFF (6,3,6,2)

Select this option to disable transmit power reduction.

Line length

The maximum performance shown in tables below and in Figure 33 is measured in ideal circumtances with the VMOHBU 0.4, 0.5 and 0.8 mm cables. In a real case, you should reserve 3 to 6 dB noise margin due to the changing circumtances in the line.

2-w	ACL2i reach (km), no noise		
Cable mm	Line rate (TS) 32	Line rate (TS) 16	Line rate (TS) 8
0.4 (37 nF/km)	4.7	6.0	6.5
0.5 (40 nF/km)	6.5	8.5	9.5
0.8 (45 nF/km)	10.0	16.5	19.0

4-w	ACL2i reach (km), no noise		
Cable mm	Line rate (TS) 32	Line rate (TS) 16	Line rate (TS) 8
0.4 (37 nF/km)	6.0	6.5	7.2
0.5 (40 nF/km)	8.5	9.5	10.6
0.8 (45 nF/km)	16.5	19.0	22.0

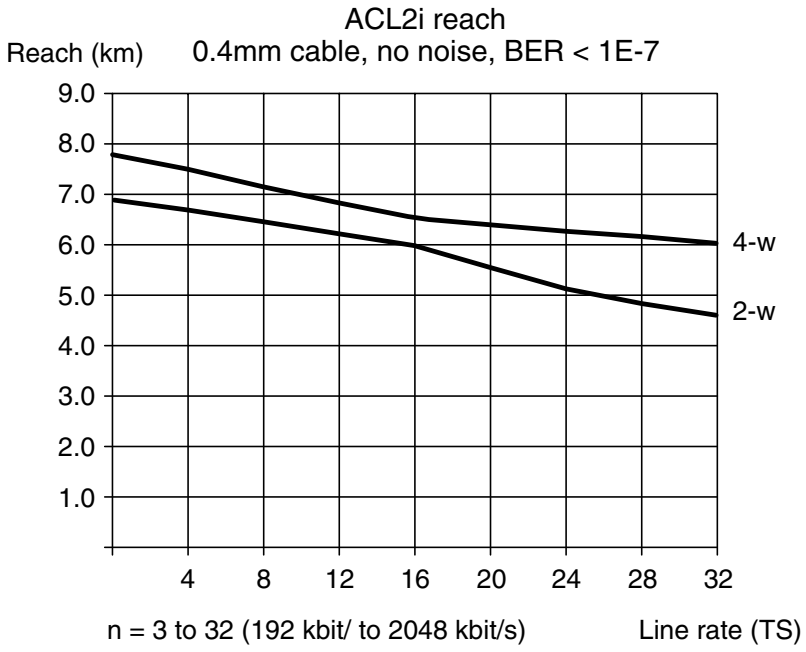


Figure 33. Maximum cable length without noise

Factors limiting connection length

The maximum connection length of ACL2i is defined by the following variables:

Cable attenuation

- The attenuation of a cable depends on thickness and pair capacitance. It also depends on impedance mismatching, resulting from connecting different types of cables, as well as from reflections caused by this.

Cable noise level

- Noise in a cable is mainly caused by a cross talk between the wire pairs. The main sources of noise are units using the same frequency band.

Cable impulse noise level

- Impulse noise in a cable can be caused, for example, by a telephone's pulse dialling signals and exchanges based on the relay technique.

Cable distortion

- ACL2i has an effective adapter equalizer, which corrects the distortion caused by the cable. However, if the connection is extremely long, the extent of the distortion may also restrict the length.

Remote power feeding

- If a 110 V remote power is used, the maximum line length may be limited. If a 145 V supply voltage is used, remote power feeding does not limit the maximum cable length. However, use of the 145 V supply voltage may be restricted due to local safety regulations.

Table 10 shows the maximum cable lengths when the remote power voltage is 110 V and Table 11 when the remote power voltage is 145 V. The values listed are the worst ones to be received assuming that the most power-consuming DTE adapters are in use and that the multiport version uses all three DTE ports.

In the tables, the values indicated with the italic font mean that the remote power feeding is a limiting factor for the maximum reach.

Table 10. Maximum cable lengths when using the 110 V remote power supply

Cable		ACL2i-pf (110 V), n=32 to						Max. reach without remote power feeding	
Diameter mm	Loop resistance ohm/km	ACL2i-rp		DNT2Mi-sp & G.703		DNT2Mi-mp & 3xV.35			
		2-w	4-w	2-w	4-w	2-w	4-w	2-w	4-w
0.4	288	*2.1 km*	*3.7 km*	*2.1 km*	*3.7 km*	*0.6 km*	*2.1 km*	4.7 km	6.0 km
0.5	184	*3.4 km*	*5.8 km*	*3.4 km*	*5.8 km*	*0.9 km*	*3.5 km*	6.5 km	8.5 km
0.6	128	*4.9 km*	*8.4 km*	*4.9 km*	*8.4 km*	*1.3 km*	*5.1 km*	8.0 km	9.2 km
0.8	72	*8.7 km*	*15.0 km*	*8.7 km*	*15.0 km*	*2.3 km*	*9.0 km*	10.0 km	16.5 km

Table 11. Maximum cable lengths when using the 145 V remote power supply

Cable		ACL2i-pf (145 V), n=32 to						Max. reach without remote power feeding	
Diameter mm	Loop resistance ohm/km	ACL2i-rp		DNT2Mi-sp & G.703		DNT2Mi-mp & 3xV.35			
		2-w	4-w	2-w	4-w	2-w	4-w	2-w	4-w
0.4	288	*3.8 km*	6.0 km	*3.8 km*	6.0 km	*1.1 km*	*3.9 km*	4.7 km	6.0 km
0.5	184	*5.9 km*	8.5 km	*5.9 km*	8.5 km	*1.5 km*	*6.2 km*	6.5 km	8.5 km
0.6	128	8.0 km	9.2 km	8.0 km	9.2 km	*2.2 km*	*8.9 km*	8.0 km	9.2 km
0.8	72	10.0 km	16.5 km	10.0 km	16.5 km	*4.0 km*	*15.8 km*	10.0 km	16.5 km

BER alarm limit (6,3,8)

The bit error rate (BER) alarm limit can be either 10^{-3} (E-3) or 10^{-6} (E-6).

BER alarm severity (6,3,9)

The severity of the line BER alarm can be viewed and changed through this menu.

8.5.4 Port settings (6,4)

Option **0 Display** shows all the port configuration settings in a similar way as the **Display** (**6,0**) option does.

Framing format (6,4,1)

The use of the G.704 framing can be selected or its use can be prevented using this menu (see Figure 23). The selections are:

- No frame
- Basic frame
- CRC multiframe
- BF monitoring
- CRC monitoring.

Note

Collection of statistics data is not possible in the **No frame** mode.

Sa bits usage (6,4,2)

With the **Sa bits usage** option, you can set the national bit to 0 or 1. The default for all of them is 1.

BER alarm limit (6,4,8)

The bit error rate (BER) alarm limit of the G.704/2M port can be checked and changed using this menu. The BER alarm limit can be either 10^{-3} (E-3) or 10^{-6} (E-6). Alarms can only appear if the frame format is either one of the CRC-4 alternatives.

BER alarm severity (6,4,9)

This menu allows you to view and change the value set to the BER alarm severity. Alarms can only appear if the frame format is either one of the CRC-4 alternatives.

8.5.5 Load factory settings (6,7)

Factory settings can be loaded by using this menu.

With this setting, it is possible to reset the EEPROM memory and to restore default structures and settings into use.

To activate the settings, you have to answer **99** (**Yes**) after receiving a request for confirmation. It takes about 30 seconds to save the information.

If you answer **1** (**Cancel**), the factory settings will not be taken into use.

Note

You may lose your management connection to the device due to change of the Q1 address, Q1 speed, or data hybrid.

8.6 ACL measurements (7)

The **ACL measurements** menu offers a set of analog measurements, readings, or temporary and unbound settings to support external measurements.

The following values can be measured for the SHDSL line signal:

- Noise margins

  The current reading of all the signal-to-noise meters.

- Rx levels

  Displays the current reading of the unit's received signal meters.

- Tx levels

  Displays the current reading of the unit's transmitted signal meters.

- Attenuations

  The current reading of all the line attenuation meters.

- Line voltage

  Shows the received line voltage when a remote-powered ACL2i-rp is used.

- Temperature

  Displays the temperature in the subrack where ACL2i is installed. The sensor in the upper right corner on the PCB measures the temperature with accuracy of ±5 °C.

8.7 ACL statistics (8)

This menu provides information on port, line, and system statistics.

Port statistics (8,1); Line statistics (8,2)

The **Port Statistics** and **Line statistics** submenus (see Figure 25) allow you to monitor the signal quality.

In the **Port/Line statistics** submenu:

- You must first select whether you want to monitor port or line statistics. Then select absolute or relative values. After this, you can define which period you want to monitor. The number of selectable periods can vary from 0 to 100, 0 standing for the current period, 1 for the last period, and 2 for the previous one, etc.

- You can choose between 0 to 100 periods of 15 minutes, or 0 to 30 periods of 24 hours to monitor a number of signal quality parameters according to G.826. For more information on statistic parameters of the line signal display, refer to Section 7.4. The format of the display is as follows:

```
15 min signal quality:
Period 1 (0 d 0 h 21 min)
UATR  (Rx):    xx
ESR   (Rx):    xx
SESR  (Rx):    xx
BBER  (Rx):    xx
UATR  (Tx):    xx
ESR   (Tx):    xx
SESR  (Tx):    xx
```

- You can view the values of the statistic parameters monitored since the last reset. See the example below.

Since last reset:	
TT:	0 d 0 h 26 min 1 s
UAT (Rx):	xx
ES (Rx):	xx
SES (Rx):	xx
BBE (Rx):	xx
UAT (Tx):	xx
ES (Tx):	xx
SES (Tx):	xx

- You can clear all statistic parameters.

8.8 Testing (9)

Result of last ST (9,1)

This menu item allows you to read the result of the last self test run in the unit.

Start self test (9,2)

By using this menu option, you can activate an extensive internal test in the unit to check its operation.

Note

The self test inhibits normal data transfer and management during it. The test takes about 20 seconds.

8.9 ACL privileges (10)

Password for privileges (10,1)

When you know the password and you want to change protected functions, you can remove protection for a set time (this time is defined using the **10,4,1** menu option) through this menu. The password is a max. 7-character code, for example abc123 <RET>. The password set at the factory is ACL2i.

PIN for privileges (10,2)

When the PIN signal (**10,4,2,3**) is used for removing protection, pin c1 (PIN) of the service connector P1 has to be grounded, for instance to pin b1. This method allows you to change the settings during the time defined through the **10,4,1** menu option. PIN signal can always be used even if a password were in use or if it were forgotten.

Cancel privileges (10,3)

Privileges are in effect during the entire monitoring time if they are not cancelled with this command. Cancellation takes place, for example, when work on the unit has been finished.

Setting parameters (10,4)

The setting parameters are permanent. They are explained below.

Password timeout (10,4,1)

The privileges obtained with the password or PIN signal are in effect for the set monitoring time. A time period of 1 to 1000 minutes can be selected. The factory setting is 10 minutes.

Protections (10,4,2)

Through this menu, you can set the protection state of the equipment. The factory setting is **No protections**.

No protections (10,4,2,1)

This operation removes the password. This means that no password or PIN signal connection is required for making control settings.

Password required (10,4,2,2)

Having chosen this option, the next time you want to establish a connection to the equipment and change settings or execute controls, you will have to use the password. The option requires that a password has been set.

Local PIN required (10,4,2,3)

Having chosen this option, the next time you want to establish a connection to the equipment and change settings or execute controls, you will have to use the PIN signal. The option requires that a password has been set.

New password (10,4,3)

This option allows you to set a new password required for changing the equipment's settings.

9 Technical specifications

This chapter describes the technical specifications and characteristics of the ACL2i line terminal.

9.1 Dimensions

The unit is constructed on a EURO-2 size PCB. Its dimensions are shown in the table below.

Unit dimensions	
Heigth	233 mm
Width	21.5 mm
Depth	160 mm
Weight	0.4 kg

9.2 Power supply

9.2.1 Local power supply (ACL2i)

ACL2i gets the operating voltage from a unit that handles the filtering, hold-up time, and overvoltage protection.

Local power supply	
Incoming battery voltage	-39 to -75 V
Input current when battery voltage < 16 V	Max. 2 mA
Power consumption	5.3 W; 4-w, line rate n=32 4.3 W; 2-w, line rate n=32

9.2.2 Local power supply and remote power feed (ACL2i-pf)

ACL2i-pf can provide remote power feed to a network terminal or a repeater over two SHDSL lines.

Local power supply and remote power feed	
Input	
Incoming battery voltage	-39 to -75 V
Input current when battery voltage 40 V	Max. 800 mA
Input current when battery voltage 60 V	Max. 500 mA
Input current when battery voltage < 35 V	Max. 5 mA
Input power, typical range	10...14 W (sp), when feeding DNT2Mi-sp 15...22 W (mp), when feeding DNT2Mi-mp
Output power	Max. 2 x 10 W
Output	
Supply voltage to SHDSL pair	110 V (or 145 V)
Supply current to SHDSL pair	90 mA (or 60 mA)
Thermal power	
Heat dissipation in subrack	6...8 W (typical range)

Note

The output voltage stays constant up to the maximum current limit. The power supply operates also during a total short circuit state feeding the maximum current to the load. After the short circuit state, the output voltage will recover to the nominal output voltage.

9.2.3 Power supply block (ACL2i-rp)

ACL2i-rp is powered remotely over the SHDSL line.

Power supply block	
Incoming voltage	50 to 150 V
Start-up voltage	90 V
Input current when voltage < start-up voltage	Max. 2 mA
Power consumption	Max. 4.5 W

9.3 Power distribution

The incoming power fed to the subrack housing ACL2i-pf amounts to maximum 30 W. The thermal power of power feeding ACL2i-pf installed in the subrack amounts to 10 W, that is, the amount of power loss in the subrack through heat dissipation. Power distribution in a remote-powered system is illustrated in Figure 34.

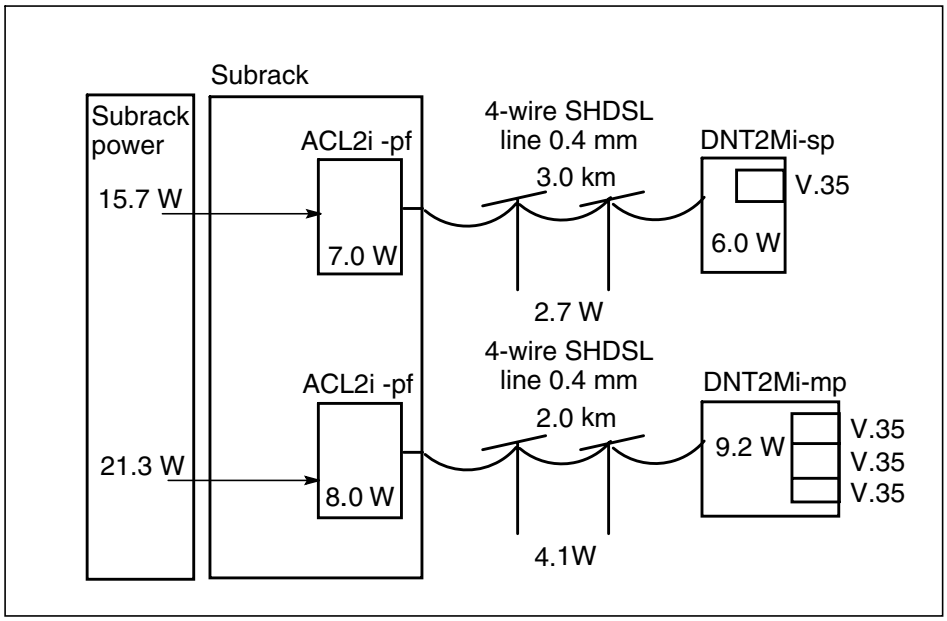


Figure 34. ACL2i power distribution

9.4 Electrical interfaces

9.4.1 2M data interface

2M data interface	
Connector	120-ohm symmetrical (2 x 32 Euro) 75-ohm asymmetrical (SMB)
Interface type	G.703 (2 Mbit/s)
Interchange circuits	
Maximum allowed timing jitter at receiver timing	According to ITU-T G.823
Maximum generated timing jitter at receiver timing	According to ITU-T G.823
Frame structure	According to ITU-T G.704
Relevant ETSI ONP standards	ETS 300 246, ETS 300 247, ETS 300 418, ETS 300 419
Electrical characteristics	
All signals	According to ITU-T G.703 2048 kbit/s
Common mode rejection	50 dB
Return loss (120 or 75 ohms; 1 kHz to 4.5 MHz)	20 dB
External clock input	
Connector	75-ohm asymmetrical (SMB)
Interface type	G.703 (2 MHz)
Protection	
Dielectric strength	500 V_{rms} 50 Hz 1 min.
Overvoltage protection	ETS 300248 1 kV common mode 250 V transversal mode

9.4.2 Line interface

Line interface 192 kbit/s to 2048 kbit/s (n x 64 kbit/s)	
Connector	2 x 32 Euro connector, male
Line type	2-wire or 4-wire
Nominal impedance	135 ohms
Line code	TC-PAM
Tx power (0 dB power backoff)	13.5 dBm @ 135 ohm (192 to 1984 kbit/s) 14.5 dBm @ 135 ohm (2048 kbit/s)
Signal bandwidth	0...300 kHz (2048 kbit/s, 2-w, -3 dB)

9.4.3 Alarm interface

Programmable Inputs/Outputs

These signals are located on the Management Interface connector.

PA1, PA2 programmable outputs	
Active state	Earth closure, I < 5 mA, U_{DC} < 2 V
Passive state	No earth closure, I < 50 µA, -75 V < U_{DC} < -12 V

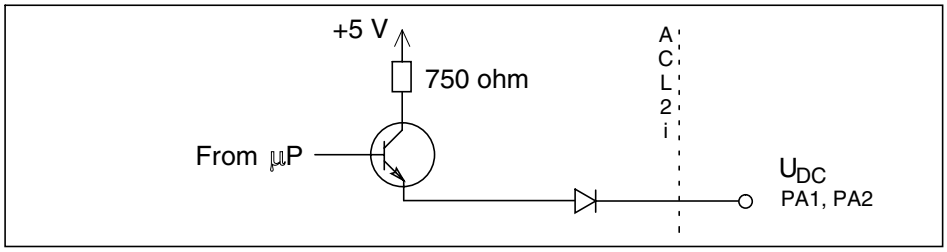


Figure 35. PA1 and PA2 circuitry

Subrack alarms	
AA, AB, AD	Open-collector alarms (backplane)

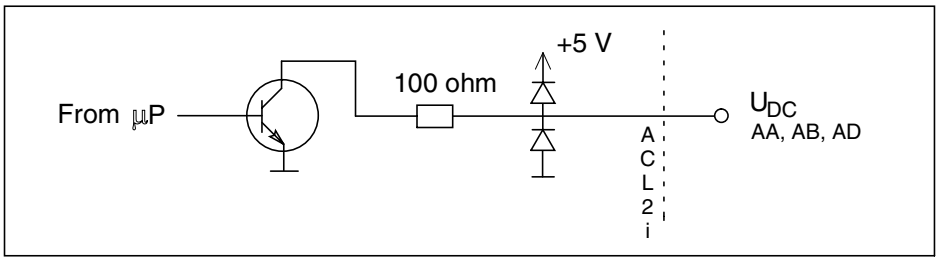


Figure 36. Alarm output circuitry

PIN input	
Active state	Ground
Passive state	Open

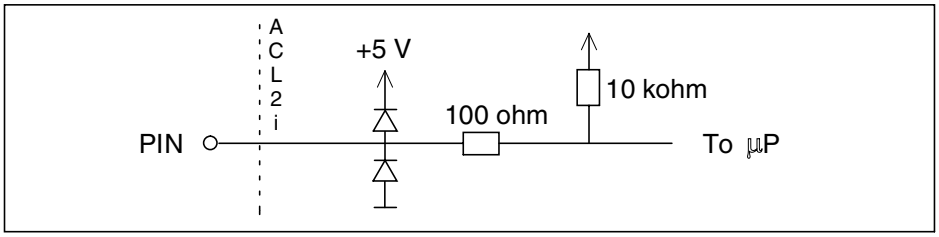


Figure 37. PIN input circuitry

9.4.4 Management interface

A Q1 interface (V.11) on the front edge for the Service Terminal (1/4 Euro connector, V.11/RS-485) or a 9-pin D-connector for the Macro STE (async., V.28).

9.5 Data lead-time

Data lead-time means the time which is needed to transfer the data from the incoming 2M data interface of ACL2i to the outgoing 2M data interface of ACL2i or DNT2Mi at the other end of the line.

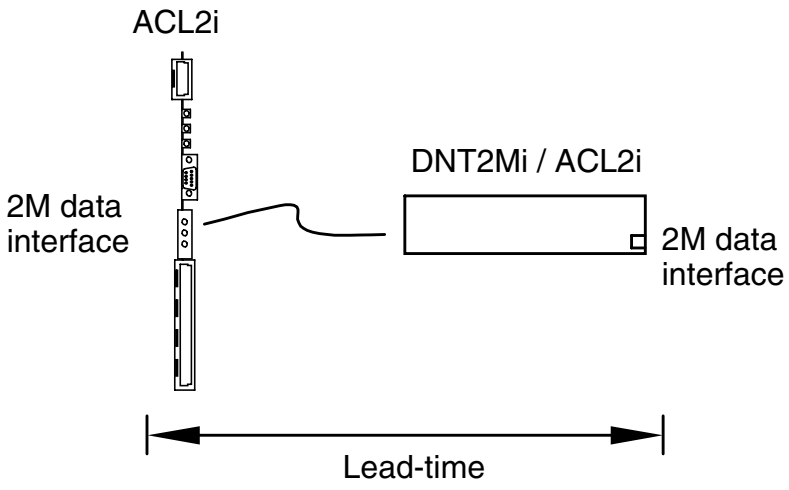


Figure 38. Lead-time definition

The lead-time of the data from ACL2i to ACL2i or DNT2Mi depends on the line rate selected as follows:

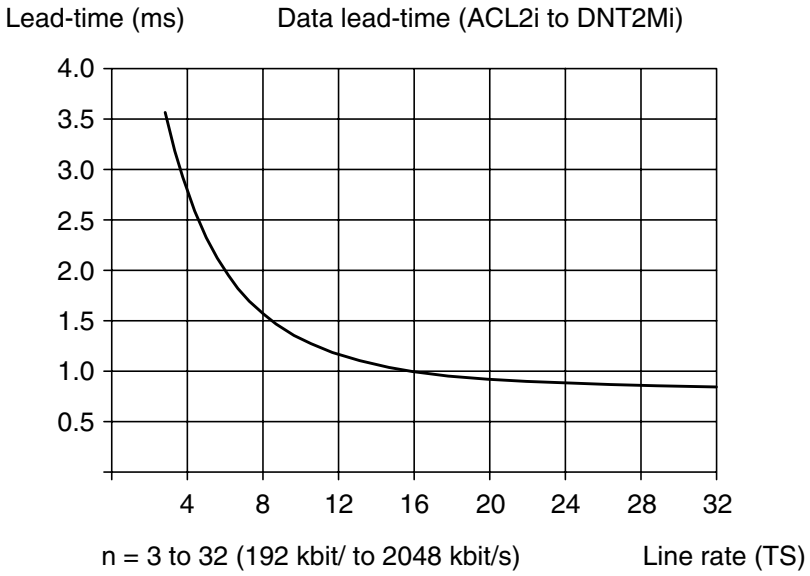


Figure 39. Data lead-time from ACL2i to DNT2Mi

9.6 Unit identification

The equipment can be identified by viewing the sticker that is located behind the service LEDs, see Figure 40. Gently pull out the plastic card to view the information.

The sticker includes two codes. The upper code includes the unit's manufacturing details. For example, the manufacturing time (year and week) is indicated after the first two digits – "0212" in the example sticker.

The lower code ("T65580.01....A" in the example) indicates the unit's product code.

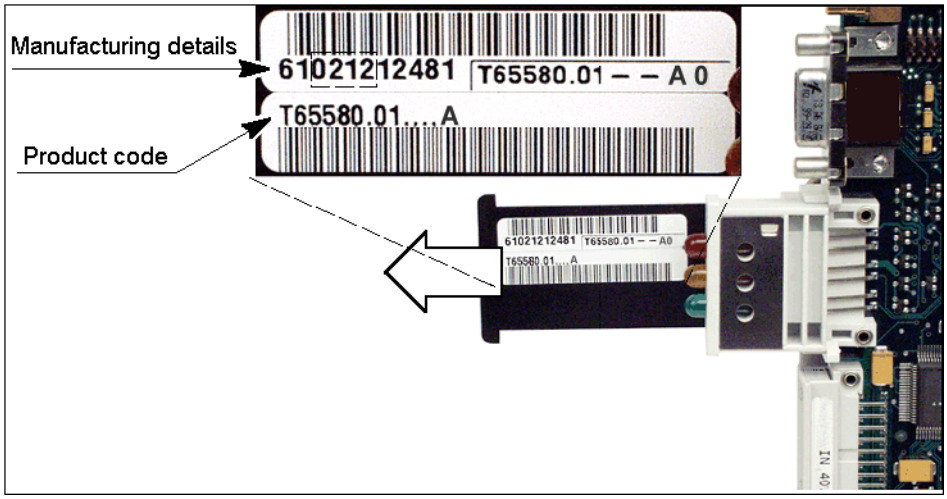


Figure 40. Example of ACL2i identification sticker

9.7 Ambient conditions

9.7.1 Environmental and mechanical requirements

The climatic and mechanical requirements of ACL2i comply with the following ETSI specifications:

Environmental and mechanical requirements	
Transportation	ETSI ETS 300 019-2-2 class 2.3
Storage	ETSI ETS 300 019-2-1 class 1.2
Operation	ETSI ETS 300 019-2-3 class 3.2

Figure 41 describes in more detail the recommended conditions for the use of the device.

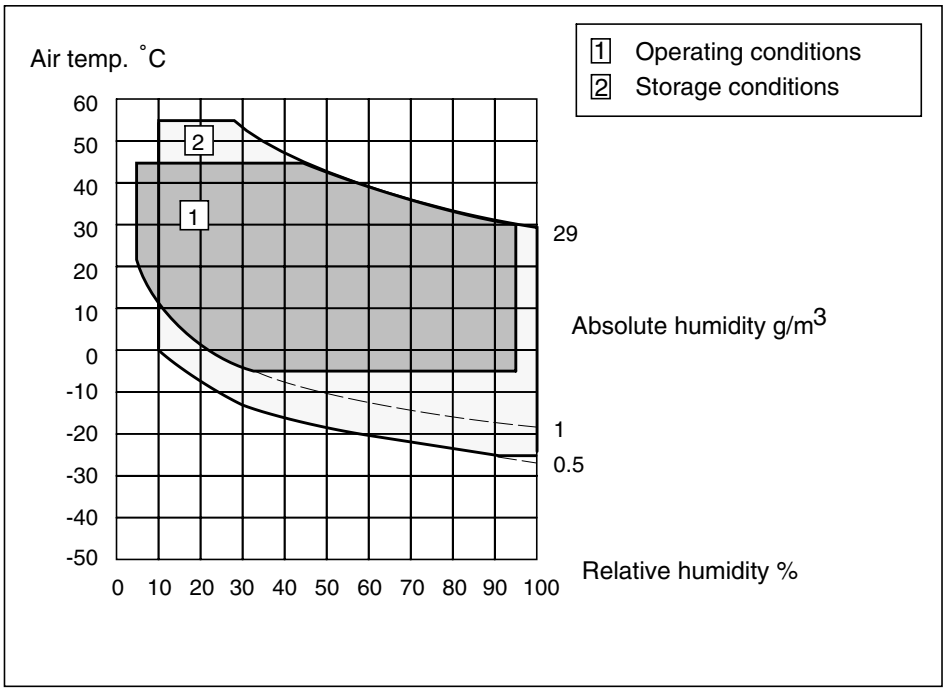


Figure 41. ACL2i climatogram

Mean time between failure (MTBF)	
ACL2i	> 70 years
ACL2i-pf	> 60 years
ACL2i-rp	> 60 years

9.7.2 Electromagnetic compatibility

Electromagnetic compatibility (EMC) of ACL2i complies with the following specifications provided that special EMC structures (for instance DYNANET EMC subrack, TM4-EMC cartridge) and shielded cables and cabling practices required by these structures are used.

Electromagnetic compatibility	
EN 300386: 2000	EMC, Telecommunications equipment
EN 55024: 1998	Immunity, Terminal equipment
EN 55022: 1998 Class B	Emission, Information technology equipment
ETS 300 386-1	EMC, Telecommunications equipment, normal priority of service

9.7.3 Safety and protection

Concerning protection and safety, ACL2i follows the requirements and specifications listed below:

Safety and protection		
DC Power supply	Dielectric strength	500 V_{RMS}
	Surge protection	1 kV according to EN 61000-4-5
Line interface	Safety	EN 60950
	Surge protection	1.5 kV according to ITU-T Rec. K.21, K.20
	50 Hz common mode test	600 V_{RMS} common mode according to ITU-T Rec. K.21, K.20

Glossary

Abbreviations

AC	Alternating current
ACL2i	2 Mbit/s line terminal at the exchange side
ACL2i-pf	Power feeding version of the 2 Mbit/s line terminal at the exchange side
ACL2i-rp	Remote-powered version of the 2 Mbit/s line terminal
ACM2	Access Multiplexer (first order)
AIS	Alarm Indication Signal
BBE	Background Block Error
BBER	Background Block Error Ratio
BER	Bit error rate. The ratio between the full number of bits transmitted in a test message and the number of received erroneous bits in that message.
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
DB2	2 Mbit/s Digital Branching equipment
DC	Direct Current
DI	Data Interface
DM2	Nokia’s fourth generation primary multiplex equipment
DN2	2 Mbit/s Dynamic Node
DNT2Mi	2 Mbit/s line terminal at the customer side
DNT2Mi-rp/mp	Remote-powered/multiport DNT2Mi
DSL	Digital Subscriber Line
DTE	Data Terminal Equipment
EMC	Electromagnetic compatibility
EOC	Embedded Operation Channel
EPSA	Enhanced Power Supply Adapter

ES	Errored Second
ESR	Errored Seconds Ratio
ETS	European Telecommunications Standard
ETSI	European Telecommunication Standards Institute
GND	Ground
HDSL	High-bit-rate Digital Subscriber Line
HW	Hardware
ITU-T	International Telecommunication Union
LED	Light Emitting Diode
LMI	Local Management Interface
MTBF	Mean Time Between Failure. Average length of time for which a device works without fault.
MSTE	Macro Service Terminal Emulator
MUX	Multiplexer unit
NE	Network Element
NMS	Network Management System
ONP	Open Network Provision
PA1/PA2	Programmable alarms of ACL2i
PBX	Private Branch eXchange
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PDH	Plesiochronous Digital Hierarchy
POTS	Plain Old Telephone Service
PSA	Power Supply Adapter
PSD	Power Spectral Density
Q1	Max. 19,2k asynchronous operations channel

SES	Severely Errored Seconds
SESR	Severely Errored Seconds Ratio
SHDSL	Single-Pair High-bit-rate DSL
SI	Service Interface
SMB	Coaxial connector type
SPA	Subrack Power Adapter
ST	Service Terminal
STU-C	SHDSL Termination Unit (STU) Central office
STU-R	SHDSL Termination Unit (STU) Remote
SW	Software
TC-PAM	Trellis Coded Pulse Amplitude Modulation
TM4	Construction Practice for ND equipment products
TMC	Transmission Management Computer
TT	Total Time
UAT	Unavailable Time
UATR	Unavailable Time Ratio

Terms

data network terminal	A piece of equipment which is used for data transmission over the subscriber loop, providing access to the trunk network.
DYNANET	Nokia's family of primary rate equipment and their tributaries used in access networks. The family includes a wide range of products: primary multiplex equipment, branching and cross-connect equipment, line equipment for copper cables and optical fibres, HDSL line terminals, and integrated multiplex and line equipment.
electromagnetic compatibility; EMC	The ability of a piece of equipment or a system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.
Nokia NMS	Nokia's system for controlling and monitoring the resources of a telecommunications network and for recording their use and performance, in order to provide telecommunications services.

product code	A code for identifying plug-in units, programs, equipment, and other sales items.
Service Terminal	A hand-held terminal with menu-based functions, used for commissioning, maintenance and operating purposes, such as reading status and alarm data on network elements, and configuring operation modes and internal settings of the equipment.
Service Terminal Emulator; STE	An NMS application allowing the user to communicate directly with the Nokia PDH network elements.